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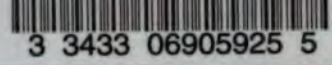
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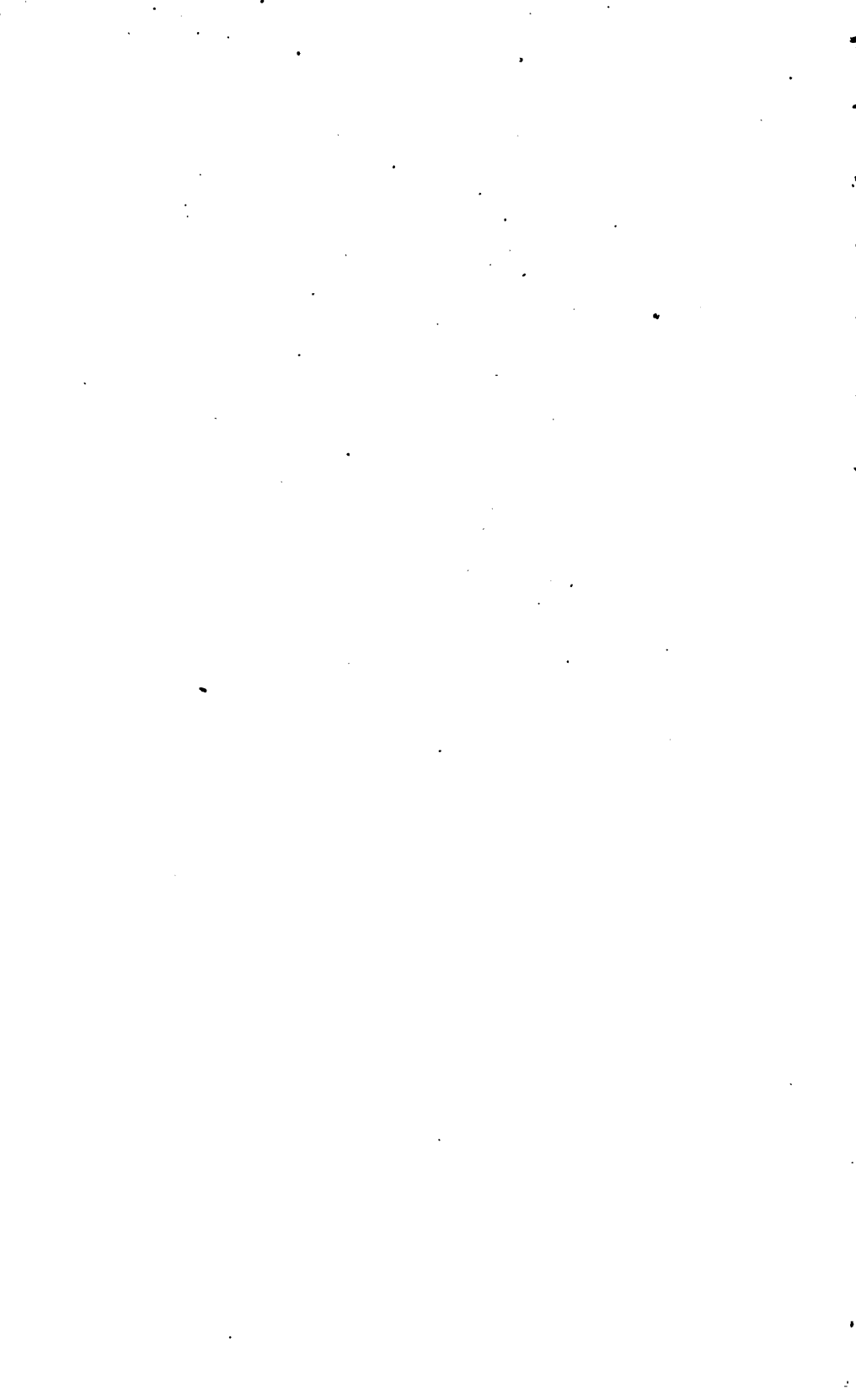
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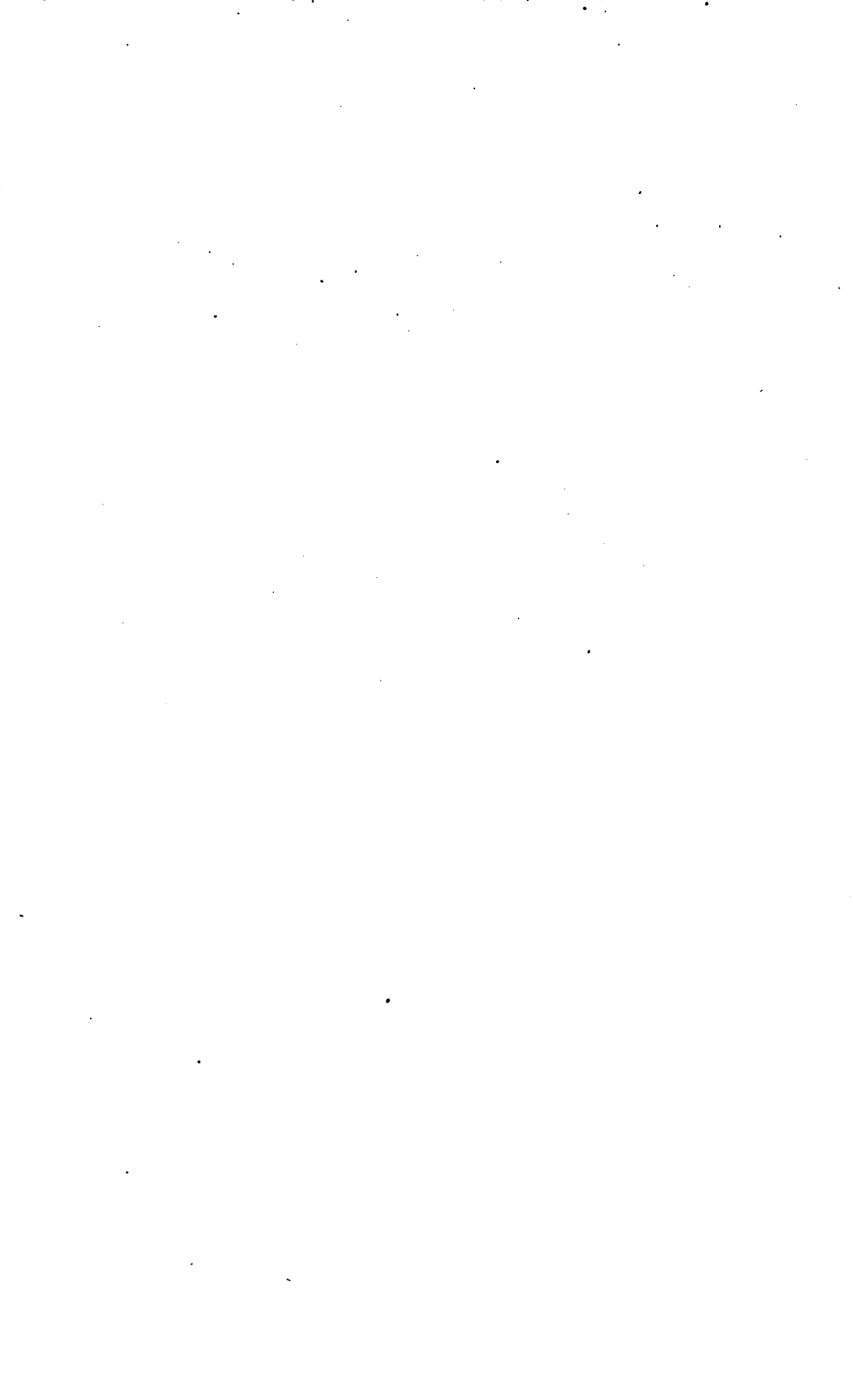


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ANNUAL REPORT

OF THE

★ PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1894.



LYNN, MASS. :
WHITTEN & CASS, PRINTERS.
1895

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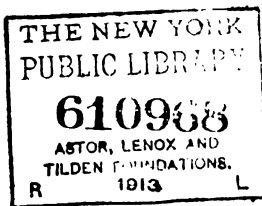


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OFFICERS FOR 1894.

W. B. LITTLEFIELD, *Pres.*,
For one year.

DAVID KNOX,
For two years.

D. A. SUTHERLAND,
For three years.

JOHN MACNAIR,
For four years.

THOS. P. NICHOLS,
For five years.

Superintendent and Clerk, JOHN C. HASKELL.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, G. S. SANBORN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHELOCK.

Foreman of Meters and Repairs, W. H. McCLAIN.

Inspectors { WINSLOW J. ROWELL,
J. FRANK POOL,
W. B. MOULTON,
JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1895.

DAVID KNOX, for one year.

D. A. SUTHERLAND, for two years.

JOHN MACNAIR, for three years.

THOS. P. NICHOLS, for four years.

W. B. LITTLEFIELD, *Pres.*, for five years.

ANNUAL REPORT.

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1895. }

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-third annual report, together with the reports of the Superintendent and Registrar.

WATER SUPPLY.

The question of a water supply for the City of Lynn assumes unusual importance from the fact that a metropolitan system of water supply is being considered by the State Board of Health under the provisions of the following act, relative to procuring a water supply for the city of Boston and its suburbs.

[ACT OF 1893. CHAPTER 459.]

Be it enacted as follows:

SECTION 1. The State Board of Health is hereby authorized and directed to investigate, consider and report upon the question of a water supply for the city of Boston and its suburbs within a radius of ten miles from the State House, and for such other cities and towns as in its opinion should be included in connection therewith.

SECT. 2. The said board shall forthwith proceed to investigate and consider this subject, including all questions relating to the quantity of water to be obtained from available sources, its quality, the best methods of protecting the purity of the water, the construction, operation and maintenance of works for storing, conveying or purifying the water, the cost of the same, the damages to property, and all other matters pertaining to the subject.

SECT. 3. The said board shall have power to employ such engineering and other assistance, and to incur such expenses as may be necessary for carrying out the provisions of this act.

SECT. 4. The said board shall report fully, with plans and estimates to the Legislature on, or before, the first Wednesday in January, in the year eighteen hundred and ninety-five, and shall append to its report, drafts of bills intended to accomplish the recommendations of the board.

SECT. 5. The total amount of money which shall be expended out of the treasury of the Commonwealth, in carrying out the provisions of this act, shall not exceed \$40,000.

The Commonwealth shall be re-imbursed for the amount expended by the cities and towns which are to receive the benefit of the system recommended in the report, in proportion to the population of each.

SECT. 6. Before incurring any expense, the board shall from time to time estimate the amounts required, and shall submit the same to the Governor and Council for their approval, and no expense shall be incurred beyond the amount so estimated and approved.

SECT. 7. This act shall take effect upon its passage.

To enable our citizens to more fully understand our situation, and the possibilities in the future, we will present a brief description of our present supply.

The construction of our system of water supply was commenced in 1870.

The first source of supply was Breed's pond, which, when full, has twenty-two feet of water at the dam. It contains 58.45 acres of water surface, a total storage capacity of 262,563,340 gallons. A water-shed, including pond surface of .93 square miles.

In 1873, Birch pond was added by constructing a dam across the valley of Beaver brook, supplied by a water-shed of .66 square miles.

On June 23, 1883, the city was authorized to take the waters of Hawkes and Penney brooks, tributaries of Saugus river, and whenever the flow of water in the river should exceed 15,000,000 gallons per day, the excess over said 15,000,000 may be diverted for the use of the city.

In the fall of 1883, work was commenced by constructing a canal and tunnel between Saugus river, at Howlett's mill, and Birch pond, connecting Hawkes and Penney brooks, separately,

to the main canal, and laying a pipe through the bottom of Birch pond. This work reached completion the following year.

In 1884, Birch pond dam was raised nine feet to its present height, giving 21.50 depth of water at dam, and a pond surface of 82 acres, with a drainage area, including the pond of .66 square miles, a total storage capacity of 381,062,901 gallons. During the year, the pipe lines leading from Breed's and Birch ponds to the pumping station, were connected.

In 1886, a pumping station was erected at the upper end of Birch pond over the canal, equipped with a steam engine and boiler of sixty-horse power, a Webber 15" centrifugal pump capable of pumping 12,000,000 gallons of water daily, from the canal into the pond. This became necessary in order to fill Birch and Breed's ponds when they were unable to fill from their own water-shed.

On the 12th of June, 1888, an order was passed by the City Council, instructing the Water Board to construct a dam on either Hawkes brook or Penney brook.

The board decided to construct a dam on Penney brook, and thought it advisable to construct a second dam across an arm of Walden pond, to give increased depth to the upper end. This pond was called Glen Lewis; both dams were erected in 1889.

Walden pond when full has seventeen feet of water at dam, a surface of 128 acres, and a water-shed including pond surface of 1.31 square miles, a storage capacity of 403,163,826 gallons.

Glen Lewis pond has a depth of seventeen feet, with a pond surface of 36 acres, a water-shed including pond surface of .36 square miles, and a storage capacity of 120,475,126 gallons.

The water-shed of these ponds, together with the water-shed of Hawkes brook, 1.92 square miles, make a total of 5.18 square miles, with a reservoir capacity of 1,167,265,193 gallons.

By an act of Legislature passed May 27, 1893, authority was given to the city of Lynn to take Saugus river and its tributaries (except Lake Quannapowitt and Crystal lake in Wakefield) as an additional water supply. This addition comprises a water-shed of 22.91 square miles, with a storage reservoir of 1,167,265,193 gallons capacity and represents our present water supply.

To show the character of the water in our supply, we present the following tables, compiled by the State Board of Health to show the relative purity of the different water supplies as shown by the yearly average number of deaths occurring from typhoid fever. Also a table giving the total number of organisms found in the water, which contribute a disagreeable taste and odor.

The following table is taken from the report of the State Board of Health, for the year ending Sept. 30, 1890, page 23, which gives the number of deaths from typhoid fever in the twenty-eight cities of Massachusetts for a period of nineteen years (1871-1889), together with the average annual mortality ratio per 10,000 of the living population from the same cause.

Holyoke, 11.32; Lawrence, 8.42; Chicopee, 8.25; Springfield, 7.74; Lowell, 7.53; Fall River, 7.21; Pittsfield, 5.95; New Bedford, 5.36; Taunton, 5.34; Haverhill, 5.30; Brockton, 5.30; Boston, 5.02; Salem, 4.99; Northampton, 4.93; Marlborough, 4.88; Quincy, 4.88; Lynn, 4.68; Worcester, 4.58; Malden, 4.55; Chelsea, 4.49; Fitchburg, 4.02; Somerville, 3.95; Gloucester, 3.95; Cambridge, 3.79; Newburyport, 3.62; Newton, 3.56; Woburn, 3.37; Waltham, 2.43; an average ratio of 5.43.

By this comparison we find that Lynn has a less death rate than that of sixteen, and greater than eleven cities.

From the same report, page 532, we find the following death rate from typhoid fever, per 10,000, for the four years 1886-1889.

Lawrence, 10.30; Lowell, 9.55; Fall River, 6.40; Holyoke, 6.13; Chicopee, 6.06; Haverhill, 4.98; Boston, 4.05; Cambridge, 3.80; Worcester, 3.11; Lynn, 2.24; an average ratio of 4.59.

The death rate in Lynn is the least of any, and less than one-half of the average.

From 1889 to 1893 the death rate of the city of Lynn from typhoid fever, per 10,000, has been 1.73.

For the past year, during which time we have been using the waters of Saugus river, the new supply, the death rate has been 1.38 per 10,000.

The low death rate shown from 1886 to 1889 of 2.24, from

1889 to 1893 of 1.73, and for 1894 of 1.38, per 10,000, proves that Lynn has nothing to fear from its water supply in this direction.

While it is not assumed that the periodical vegetable growths occurring in all surface water reservoirs are dangerous to health, the presence of large numbers of these organisms render the water disagreeable both in taste and odor.

A comparative test of the purity of our own water supply in this respect can be made from the latest monthly microscopical examinations published by the State Board of Health for the year ending Sept. 30, 1893, of cities in the state taking their water from surface water supplies. In presenting this table, all figures are based on twelve examinations, where less were taken the number is given and the comparison is made proportionally.

In cases as in Boston, Cambridge and Lynn, where examinations were made from reservoirs in which the water flows through reservoirs lower down, the lower reservoir is given.

Table showing the total organisms, per cubic centimeter, as determined by the microscopical examinations of the water supplies by the State Board of Health in 1893.

Boston	Mystic lake	31,121
Quincy	Reservoir	19,952
Woburn	Horn pond	17,370
Brockton	Reservoir	13,818
Salem, six examinations	Wenham lake	13,714
Beverly, six examinations	Wenham lake	13,714
Cambridge	Fresh pond	13,600
Springfield, eight examinations	Ludlow reservoir	12,735
Fitchburg	Scott's reservoir	11,848
Worcester	Tatnuck brook reservoir	9,484
Boston	Reservoir No. 3	7,366
Malden	Spot pond	6,961
Medford	Spot pond	6,961
Melrose	Spot pond	6,961
Boston	Lake Cochituate	6,855
Lynn	Birch pond	5,729
Lynn	Walden pond	5,213
Holyoke, six examinations	Wright and Ashley ponds	4,760
New Bedford, eight examinations	Little Quittacas pond	4,463
Lynn	Breed's pond	3,033

Worcester	Lynde brook reservoir	2,815
Boston	Reservoir No. 2	2,541
Marlborough	Lake Williams	1,002

By these tables we find the water of Birch pond better than that of fifteen, and poorer than seven. Walden pond better than sixteen and poorer than six; Breed's pond better than nineteen and poorer than three, and that the average in the Lynn reservoirs is less than one-half the number contained in the general average in all the reservoirs given in the table.

DURATION OF SUPPLY.

Until 1894, a water-shed of 5.18 square miles has supplied all water needed. In 1894, water was first taken from Saugus river; this water-shed comprises an addition of 17.73 square miles, making a total of 22.91 square miles, or more than four times our former area.

This area (of 13.68 square miles) contains less population to the square mile than that included in the water-shed of the proposed metropolitan supply, about five square miles of which is covered by the public park, and land purchased by the water department to protect the water-shed, together with rights of flowage owned by the city of Lynn, thereby precluding all possibility of any encroachments by population. In the water-shed of 17.73 square miles, added in 1893, 8.50 square miles, has less population per square mile than that of the proposed metropolitan supply, and will not be contaminated with sewerage from any city or town.

It can be provided with storage reservoirs sufficient to utilize the entire rainfall, as it becomes necessary to meet the increased consumption, principally secured by raising the dams of our present reservoirs. No reason exists why this supply should not increase in purity in the future, as the reservoir attains greater age.

To compare the length of time this addition will supply Lynn and Saugus with the length of time the metropolitan source will supply the metropolitan district, we will use the estimated population given by the State Board of Health for 1895.

Lynn and Saugus, 65,784; metropolitan district, 984,301, or

14.95 times greater. Addition drainage area of Lynn and Saugus, 8.50 square miles; metropolitan district, 118 square miles, or 13.88 times greater. These figures show that this additional supply will supply Lynn and Saugus for a greater length of time than the metropolitan system would supply the metropolitan district.

When the limit of this supply is reached there still remains 9.23 square miles of our present supply, and a large water-shed of the Ipswich river that can be diverted into the Saugus river valley. The Ipswich river area has a less population to the square mile than the Nashua river, and since 1865 has shown a decrease instead of an increase.

No towns in its area are provided with sewers, and the water is certainly as pure as that of the water-shed below, which is the source of supply for Salem, Beverly, Danvers and Middleton.

From this comparison of the various water supplies of the state, furnished from reports of the State Board of Health, the citizens of Lynn are to be congratulated on the excellent character of their present water supply, and on the favorable opportunity that exists to secure a future supply from the drainage area that adjoins our present area, and of sufficient elevation to flow by gravity into the present supply.

HAWKES POND.

The following order was passed by the City Council :

IN BOARD OF MAYOR AND ALDERMEN, }
December 4, 1894.

Ordered: That the Water Board be and hereby is authorized to build a storage basin in Hawkes brook valley, at a cost not exceeding \$125,000.00 and that the same be charged to the account of water construction.

Work has not yet been commenced on its construction.

The pond as contemplated will cover seventy acres, having twenty-five feet of water at the dam, and will contain 287,000,000 gallons; upon its completion, the waters of Saugus river can be diverted from a point above the railroad at Montrose, by means

of a conduit into Hawkes pond, then from Hawkes pond by a conduit to Walden pond, thus making the proportion of the various drainage areas to the ponds much more equal.

WALDEN POND.

In June, the water of Walden pond was drawn off to give an opportunity to remove the soil from the bed of the pond in the vicinity of the dam. About eleven acres were cleaned; a portion of this area had a peaty deposit of great depth, and very yielding in character. The experiment of covering this area with sand and gravel was tried, the expense being slight compared with that of removing the entire deposit, and will probably be as effectual in checking the growth of the algæ.

An arm of the pond containing about 12.80 acres, being covered with but a slight depth of water, was cut off by constructing a dam across the lower end. The bed of the pond has been burned over, and is exposed to alternate freezing and thawing through the winter.

HIGH SERVICE.

His Honor the Mayor, in his inaugural, recommended the erection of a stand-pipe for a better water service for the Highlands. The Water Board presume that some action will be taken on his recommendation by the City Council during the present year.

BIOLOGICAL.

The weekly biological examinations of the water in all of our reservoirs and Saugus river, have been conducted, as before, by Mr. George C. Whipple, the biologist in charge of that branch of the Boston water supply, and the comparison of the water thus afforded has proved of material assistance in securing the best water in the different reservoirs.

STREET MAINS.

About one mile (5,052 feet) of cement-lined pipe was taken out and replaced with cast-iron. During the year ninety-nine

bursts occurred, a decrease of twenty from the previous year. The greater portion of the cement-lined pipe, in the business portion of the city, has been relaid, covering the points where the greatest liability from damage to property by water exists.

It is the intention of the board to replace the cement-lined pipe with cast-iron only where the cost of maintenance approaches the interest on the cost of relaying the pipe.

Mains were laid in all streets petitioned for where the abutters were willing to guarantee five per cent. on the cost of laying the pipes, until the water rates equal the amount required.

WATER SUPPLY FOR FIRE PURPOSES.

The city of Lynn is exceptionally well provided with a water supply for fire purposes. The water is delivered from the distributing reservoir, on Pine hill, by three mains, 30", 24" and 16", respectively, to Walnut street at the pumping station.

From the pumping station, a 20" main extends through Walnut, Winter, Cedar, Mall and North Common streets, City Hall square, Central avenue to Andrew street, and through Liberty from Central avenue to Willow street. A 16" main from the pumping station passes through Walnut, North Federal, Marion, Centre, Elm, Summer and Andrew streets, connecting at that point with the 20" main, then through Central avenue and Union to Silsbee street. A 12" pipe from the 30" main at the pumping station is laid through Walnut, Kirtland, Marion, Federal and North Common streets, connecting with the 20" main at Mall street. A 12" main from the reservoir for the high service, runs down the reservoir road to Linwood street, then through Tapley, Lovers' Leap avenue, Forest, Franklin streets and Western avenue to Washington street, where it is connected to the low service and can be used if necessary. In the business part of the city, 1,000,000 gallons per hour can be delivered if necessary.

LAND PURCHASED IN 1894.

WALDEN POND.

H. W. Munroe, $3\frac{1}{4}$ acres	\$81 25
J. C. Newhall, $20\frac{1}{2}$ acres	512 50
E. & A. Mansfield, 4 acres	200 00
I. K. Harris, 3 acres	85 50
P. A. Chase, $7\frac{1}{4}$ acres	189 25
A. A. Hood, $4\frac{1}{2}$ acres	90 00
Mary A. Proctor, 2 acres	45 00
Mt. Holyoke College, $5\frac{3}{4}$ acres	105 00
F. W. Mace, 3 acres	75 00
	<hr/>
	\$1,383 50

BREED'S POND.

J. W. Ingalls	300 00
E. M. Ingalls	400 00
	<hr/>
	\$2,083 50

Respectfully submitted,

W. B. LITTLEFIELD,

President.

REPORT OF THE WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
Lynn, January 1, 1895. }

To W. B. Littlefield, Esq., President Public Water Board:

SIR,—I herewith present the financial condition of the department for the year ending Dec. 31, 1894.

RECEIPTS.

Fixture rates	\$131,051 58
Meter rates	37,143 25
Additional rates	3,255 33
Miscellaneous	1,662 37
Fines	119 20
Total revenue	<u>\$173,231 73</u>
Extra pipe, etc.	11,052 11
Total receipts as per cash book	<u>\$184,883 84</u>

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$173,231 73
Amount outstanding, fixture rates	\$6,171 68
Amount outstanding, meter rates	1,185 97
Amount outstanding (not due), meter rates	<u>10,676 05</u>
	18,033 70
	<u>\$191,265 43</u>
Deduct amount due January 1, 1894	14,609 93
Revenue for year 1894	<u>\$176,655 50</u>
Revenue for year 1893	<u>177,803 56</u>
Decrease	\$1,148 06

STATEMENT OF NET EARNINGS FOR 1894.

Revenue	\$176,655 50
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EXPENSES.

Interest	\$74,608 74
Maintenance	47,449 30
Rebate to Saugus	2,549 88
	<hr/>
	124,607 92
Net earnings	<hr/> \$52,047 58

EXPENDITURES.

MAINTENANCE.

Salaries and office expenses	\$9,409 72
Pumping station expenses	9,404 94
Repairs on mains	8,967 77
Repairs on services	5,635 16
Walden pond	4,893 05
Meters	2,137 76
Stable and workshop	1,755 57
New supply	1,399 06
Pumping expenses (Birch pond)	1,160 35
Legal expenses (Green case)	595 60
Laboratory	545 50
Engines and boilers	412 51
Damages	407 05
Engine house	387 91
Birch pond	176 25
Breed's pond	115 85
Reservoir	45 25
	<hr/>
	\$47,449 30

CONSTRUCTION EXPENSES.

Mains, hydrants and gates	\$8,092 02
Services and courts	7,291 11
New supply	2,600 00
Meters	2,433 88
Walden pond	1,474 50
Breed's pond	700 00
	<hr/>
	\$22,591 51
Amount received for extra pipe, etc.	11,652 11
	<hr/>
Net	\$10,939 40

STATEMENT

SHOWING COST OF WORKS TO JANUARY 1, 1895

Mains, hydrants and gates	\$822,811 08
New supply and land	317,390 75
Services and courts	268,170 42
Walden and Glen Lewis ponds	182,658 12
Engines and boilers	140,327 29
Reservoir and land	131,581 49
Birch pond and land	93,471 84
Engine house and land	57,562 39
Breed's pond and land	57,135 28
Pipe conduits and land	45,293 98
Force mains and land	41,546 13
Meters	37,129 43
Highland service	12,431 17
Tubular wells	9,374 02
Engineering	8,564 99
Hawkes' pond	2,306 52
Work shop and stable	2,056 97
Total cost	<u>\$2,229,811 87</u>
Less amount received for pipe	\$116,254 44
Less amount received for wood	4,267 68
Less amount received for Deane pump	<u>2,000 00</u>
	<u>122,522 12</u>
Total net cost	<u>\$2,107,289 75</u>

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	10,835	
Number of services in Saugus	607	
Total	<u> </u>	11,442
Number put in during the year (Lynn)	318	
Number put in during the year (Saugus)	81	
Total	<u> </u>	399
Number extended during the year (Lynn)	35	
Number extended during the year (Saugus)	5	
Total	<u> </u>	40
Number discontinued		68
Number not in use		101
Turned on (new services)		340
Turned on (re-occupied)		329
Turned on (rates and fines paid)		10
Shut off (for vacancy)		432
Shut off (for non-payment)		18

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
 ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
 CONTAINED IN THE SAME, TOGETHER WITH THE
 NUMBER OF FIRE HYDRANTS, DEC. 31, 1894.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	10,092	563	10,655
Stores and shops	1,084	20	1,104
Factories	212	2	214
Offices	474	11	485
Restaurants and saloons	60		60
School-houses	45	4	49
Churches	27	5	32
Bakeries	32		32
Laundries	20		20
Engine-houses	9	3	12
Families	15,358	667	16,025
Boarding-houses	217	3	220
Faucets	27,496	1,055	28,551
Water-closets	11,406	249	11,655
Bath tubs	4,298	164	4,462
Hand hose	2,936	199	3,135
Urinals	216	4	220
Heaters	672	23	695
Stationary engines	149	2	151
Motors	25		25
Greenhouses	35	2	37
Drinking fountains	25		25
Standpipes, fire	15	1	16
Standpipes for water carts	42		42
Sewer connections	17		17
Automatic sprinklers	78	2	80
Hydrants	785	128	913

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	\$8,989 00
From January 1, 1872, to January 1, 1873	27,568 16
From January 1, 1873, to January 1, 1874	47,992 61
From January 1, 1874, to January 1, 1875	53,545 61
From January 1, 1875, to January 1, 1876	52,553 26
From January 1, 1876, to January 1, 1877	60,867 12
From January 1, 1877, to January 1, 1878	64,002 50
From January 1, 1878, to January 1, 1879	67,570 14
From January 1, 1879, to January 1, 1880	73,949 80
From January 1, 1880, to January 1, 1881	79,635 12
From January 1, 1881, to January 1, 1882	80,967 76
From January 1, 1882, to January 1, 1883	94 419 52
From January 1, 1883, to January 1, 1884	98,893 54
From January 1, 1884, to January 1, 1885	114,903 86
From January 1, 1885, to January 1, 1886	110,089 11
From January 1, 1886, to January 1, 1887	116,375 70
From January 1, 1887, to January 1, 1888	123,507 73
From January 1, 1888, to January 1, 1889	134,480 27
From January 1, 1889, to January 1, 1890	141,865 53
From January 1, 1890, to January 1, 1891	154,788 27
From January 1, 1891, to January 1, 1892	171,744 85
From January 1, 1892, to January 1, 1893	188,979 88
From January 1, 1893, to January 1, 1894	177,803 56
From January 1, 1894, to January 1, 1895	176,655 50
	<hr/>
	\$2,422,148 40

FUNDED WATER LOAN.

When Payable.	Rate Per Cent.	Amount
Jan. 1, 1896	6	\$50,000
Mar. 25, 1896	4	100,000
Jan. 1, 1899	5	50,000
Jan. 1, 1900	5	50,000
Apr. 1, 1900	4	10,000
Jan. 1, 1901	5	50,000
Mar. 1, 1903	4	8,000
May 1, 1904	3½	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3½	71,500
Dec. 1, 1905	3½	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3½	31,000
Mar. 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3½	6,000
Apr. 1, 1916	3½	2,000
May 1, 1916	3½	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3½	6,500
June 1, 1917	3½	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
		<hr/>
		\$1,615,300

REPORT OF THE SUPERINTENDENT.

To William B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1894.

WATER SUPPLY.

On January 1, 1894, Breed's pond contained 47,947,812 gallons of water, Birch pond 21,035,323 gallons, Walden pond 374,977,162 gallons and Glen Lewis 47,552,052 gallons, a total of 491,502,349 gallons, equal to 131 days' supply.

Early in the year water was pumped into Birch Pond from the canal, a total of 235,473,000 gallons being needed to fill the pond.

On June 1, Breed's and Birch ponds were filled to their greatest capacity. In all of the ponds we had 1,004,750,355 gallons in store for the summer months, equal to 249 days' supply based on the daily consumption for 1894.

In June and July 109,696,691 gallons were taken from the canal. On July 12, the use of water from the canal was discontinued and no water was taken from that source until November 19. The entire supply for this period was taken from Breed's and Birch ponds. On June 16, we commenced to draw off the water from Walden pond which was allowed to waste into Saugus river. This was done to afford an opportunity to clean the bed of the pond. A part of the pond, immediately above the dam, where the deposit of soil was very deep, was covered with sand and gravel; from the remaining portion all organic matter was removed. The area cleaned covered 11.50 acres. An arm of the pond at the upper end towards Lynnfield where the depth of water was shallow was separated from the lower

pond by a dam constructed with soil removed from the bed of the pond immediately below. A pipe provided with a gate was laid under the dam. The area cut off from the pond is 12.80 acres. In January, 1895, the bed of the pond was burned over. Weekly microscopical examinations have been made of the top and bottom water in all of our reservoirs and Saugus river. The work has been performed principally by Miss M. W. McFarlane under the direction of George C. Whipple, the biologist engaged in making biological examinations for the City of Boston. No organisms liable to come from sewage, or any injurious to health were discovered. The knowledge of the character of the water thus obtained enables us to use the best water obtainable at all times.

CANAL.

When water was first admitted into the brick conduit near Howlett's mill it was found that some portions were leaky. Having a large amount of water running to waste no attempt was made to repair the leaks until the water was drawn off in the summer, when the entire conduit was examined and all leaks stopped. Two bridges across the canal were repaired by new planking. The canal at present is in good condition.

PUMPING STATION.

The roofs and gutters of the building have been thoroughly repaired and painted, and new supports made for the iron railings on the engine house roof. The ventilator on the boiler house which was badly rusted has been repaired, and the coving and wood-work on the outside of the building has been painted and put in first-class condition. A new water-closet has been put in, and a cesspool built in the yard to receive the drainage. No repairs have been needed in the Leavitt engine, which is doing its work in its usual efficient manner. The work of the Loretz engine has been very satisfactory, showing an increased duty over last year. The old return tubular boilers have now been in use twenty-two years and are still in excellent condition. The wear on them has been very even, and they show no pitting.

or undue strains, but their age will soon oblige us to reduce the working pressure, when we shall be obliged to replace them. A Lamprey furnace mouth-protector has been placed in the furnace of boiler No. 2, and also in the furnace of the Moore boiler. New posts have been fitted to the gate in the pump well on the Breed's pond pipe.

STREET MAINS.

During the year 5,052 feet of cement-lined pipe was taken up and replaced with cast iron mains in the following streets: Mt. Vernon, Tudor, Tremont, Stewart, Pleasant from Summer to Tremont, Union from Silsbee to Chestnut. A total of ninety-nine bursts in the cement-lined pipes came in the year, being twenty less than in 1893. Nine thousand fifty-eight feet of cast-iron pipe, from 4" to 10" in diameter, have been laid in twenty-four streets. Of this 5,052 feet replaced cement-lined pipe previously laid. One thousand, four hundred and fifty-three feet of smaller pipe has been laid in courts as mains; 6 gates have been set in connection with the new mains; 10 gates were set in place of old ones where pipe was changed to larger sizes in relaying the cement-lined pipes; 10 leaks in gates were repaired; 36 main-gate boxes raised where streets were graded; 59 new main gate boxes put in place of old ones.

In trenching for mains 667 feet of ledge has been excavated; 318 services have been put in, aggregating 14,885 feet in length; 35 services have been extended, of a total length of 1,470 feet; 68 have been discontinued; 20 services renewed; 167 were changed from the old pipe to the new; 959 corporations have been drilled out; 96 lead pieces put in place of old ones; 301 new iron stop boxes to replace old wooden ones; 154 leaks in service pipes were repaired; 50 service boxes were cleaned out and reset; 5 service boxes changed for curbstones; 113 service boxes raised where streets were graded; 18 services were lowered; 32 services were thawed out; 83 new stop-and-wastes were put in to replace old ones; 14 private hydrants were repaired; 231 new meters were set; 145 meters were

taken off, tested and repaired; 10 meters were taken out; 5 outside meter boxes put in; 7 drinking fountains repaired.

The following tables show the work performed by the department during the year.

Respectfully submitted,

JOHN C. HASKELL,

Superintendent.

ANALYSIS OF WATER IN BIRCH POND BY STATE BOARD OF HEALTH.

PART IN 100,000.

DATE OF COLLECTION.	APPEARANCE.		ODOR.	RESIDUE ON EVAPORATION.				AMMONIA.		NITRO- GEN AS		Iron.	Oxygen consumed.
	Turbidity.	Sediment.		Filter.	Hot.	Total.	Fixed.	Free.	Total.	Albuminoid.			
										In Solution.	In suspension.			Chlorine.	Nitrates.	Nitrites.	Hardness.
Jan. 3 Jan.	4 Distinct.	Slight.	0.75 Fairly vegetable, and unpleasant.	Distinctly vegetable and unpleasant.	4.60 1.90 2.70	0.80	0.084	0.084	0.084	0.000	0.000	0.000	0.000
Feb. 7 Feb.	5 Distinct, etc.	Slight.	0.80 Distinctly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	4.45 1.85 2.60	0.85	0.14	0.085	0.085	0.000	0.000	0.000	0.000
Mar. 7 Mar.	8 Distinct.	Slight.	0.75 Decidedly vegetable and unpleasant.	Decidedly vegetable and unpleasant.	4.15 2.00 2.15	0.80	0.084	0.084	0.084	0.000	0.000	0.000	0.000
April 3 April	5 Distinct.	Cons. yellowish green.	0.55 Decidedly vegetable and unpleasant.	Decidedly vegetable and disagreeable.	3.75 1.45 2.30	0.80	0.118	0.040	0.078	0.000	0.000	0.000	0.000
May 7 May	8 Slight.	Considerable.	0.45 Decidedly vegetable.	Distinctly vegetable and pungent.	2.55 1.20 1.35	0.80	0.085	0.085	0.085	0.000	0.000	0.000	0.000
June 10 June	6 Slight green, green.	Considerable.	0.70 Fairly vegetable.	Distinctly vegetable and pungent.	4.40 1.75 2.65	0.80	0.084	0.084	0.084	0.000	0.000	0.000	0.000
July 10 July	10 Distinct green.	Very slight.	0.55 Fairly vegetable.	Distinctly vegetable and disagreeable.	3.35 1.35 2.00	0.80	0.085	0.085	0.085	0.000	0.000	0.000	0.000
Aug. 8 Aug.	8 Distinct.	Slight green.	0.50 Distinctly vegetable and disagreeable.	Distinctly vegetable and disagreeable.	4.00 1.60 2.40	0.80	0.079	0.078	0.078	0.000	0.000	0.000	0.000
Sept. 11 Sept.	10 Distinct green.	Slight brown.	0.60 Fairly vegetable.	Distinctly vegetable and disagreeable.	4.95 1.70 3.25	0.80	0.084	0.084	0.084	0.000	0.000	0.000	0.000
Oct. 10 Oct.	10 Slight.	Cons. green.	0.60 Distinctly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	4.15 1.90 2.25	0.80	0.085	0.085	0.085	0.000	0.000	0.000	0.000
Nov. 12 Nov.	13 Very slight.	Very slight.	0.50 Distinctly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	7.45 1.40 6.05	0.80	0.084	0.084	0.084	0.000	0.000	0.000	0.000
Dec. 10 Dec.	11 Very slight.	Slight.	0.60 Distinctly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	6.65 1.30 5.35	0.80	0.084	0.084	0.084	0.000	0.000	0.000	0.000

ANALYSIS OF WATER FROM TAP IN CITY BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITRO-GEN AS			Iron.	Oxygen consumed.				
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.		Chlorine.			Nitrates.	Nitrites.	Hardness.	
											Aluminoid.	In solution.							In suspension.
Jan. 10	Jan. 11	None.		Very slight.	0.80	Distinctly vegetable	4.55	2.65	1.90	.0694			.0248	.0238	.0020	.49	.0060	.0003		0.6	.0300	.7917
Feb. 7	Feb. 8	Slight.		Slight.	0.80	Distinctly vegetable	4.65	2.35	2.30	.0120	.0990	.0270	.0020	.47	.0120	.0002	0.8	.0600	.8080
Mar. 7	Mar. 8	Slight.		Slight brown.	0.75	Decid. veg., grassy and unpleasant.	4.35	2.00	2.35	.0026	.0220	.0184	.0036	.51	.0100	. . .	1.1	.0525	.6424
April 5	April 5	None.		Slight.	0.83	Faintly vegetable.	4.95	1.85	3.10	.0008	.0188	.0170	.0018	.62	.0120	. . .	1.6	.0140	.6083
May 7	May 8	Very slight.		Slight.	1.00	Distinctly vegetable and sweetish.	5.70	2.75	2.95	. . .	.0204	.0190	.0014	.67	.0120	. . .	1.7	.0200	.8405
June 6	June 6	Slight.		Slight.	1.00	Distinctly vegetable	5.10	2.30	2.80	.0006	.0230	.0194	.0036	.51	.0070	. . .	1.4	. . .	.7399
July 10	July 11	Slight.		Slight.	0.60	Faintly vegetable.	4.30	1.70	2.60	.0004	.0186	.0172	.0014	.67	. . .	. . .	1.5	. . .	.5529
Aug. 8	Aug. 9	Very slight.		Slight.	0.75	Distinctly vegetable	4.85	1.50	3.35	.0004	.0204	.0182	.0022	.58	.0050	. . .	1.1	. . .	.5150
Sept. 11	Sept. 12	Slight.		Slight.	0.55	Faintly vegetable.	4.05	2.00	2.05	. . .	.0216	.0202	.0014	.53	. . .	. . .	1.3	.0200	.4466
Oct. 9	Oct. 10	Slight.		Considerable.	0.60	Faintly vegetable.	3.85	1.45	2.40	.0002	.0196	.0172	.0024	.55	. . .	. . .	0.9	.0350	.4241
Nov. 12	Nov. 13	Very slight.		Very slight.	0.70	Distinctly vegetable and unpleasant.	4.05	1.35	2.70	.0008	.0240	.0214	.0026	.64	.0070	.0001	1.4	.0435	.5632
Dec. 10	Dec. 11	Very slight.		Very slight.	0.73	Distinctly vegetable fragrant.	4.75	1.50	3.25	. . .	.0168	.0152	.0016	.63	.0070	. . .	1.6	.0220	.5467

ANALYSIS OF WATER IN WALDEN POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.		NITROGEN AS		Iron.	Hardness.	Oxygen consumed.					
Collection.	Examination.	Turbidity.	Sediment.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.				Chlorine.	Nitrates.	Nitrites.		
Jan. 3	Jan. 4	Slight.				Distinctly vegetable and unpleasant.	Distinctly vegetable	5.40	2.95	2.45	.0004	.0340	.0304	.0036	.54	. . .	. . .	0.9	.0175	1.345
Feb. 7	Feb. 8	Slight.				Faintly vegetable.	Faintly vegetable.	4.55	2.30	2.25	.0126	.0284	.0236	.0048	.51	.0030	.0001	0.6	.0400	1.080
Mar. 7	Mar. 8	Slight.				Distinctly vegetable and unpleasant.	Distinctly disagreeable.	2.80	1.20	1.60	.0126	.0228	.0198	.0030	.32	.0030	. . .	0.3	.0550	.540
April 5	April 5	Cons. yellowish green.				Distinctly vegetable and unpleasant.	Distinctly vegetable and disagreeable.	3.25	1.85	1.40	.0010	.0360	.0230	.0130	.44	.0030	. . .	0.3	.0845	.874
May 7	May 8	Considerable.				Decidedly vegetable and unpleasant.	Decidedly vegetable and unpleasant.	3.40	1.60	1.80	.0070	.0366	.0232	.0074	.43	. . .	. . .	0.3	.1200	.650
June 6	June 6	Heavy yellow gelatinous green.				Decidedly vegetable and unpleasant.	Decidedly vegetable and sweetish grassy.	4.30	2.45	1.85	. . .	.0560	.0240	.0320	.58	. . .	. . .	0.3	. . .	.860

ANALYSIS OF WATER IN GLEN LEWIS POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

Collection.	APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.		NITROGEN AS		Oxygen consumed.						
	Turbidity.	Sediment.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.		Chlorine.	Nitrites.	Nitrates.	Hardness.	Iron.	
																		Albuminoid.
Jan. 3	4	Distinctly green.	0.80	Decidedly vegetable and unpleasant.	Decidedly vegetable and unpleasant.	4.65	2.00	2.65	.0004	.0528	.0264	.0264	.50	. . .	. . .	.08	.0100	.8666
Feb. 7	8	Distinct cons. scum.	0.70	Decidedly aromatic, and unpleasant.	Decidedly aromatic, and unpleasant.	3.95	1.85	2.10	.0240	.0354	.0228	.0126	.40	.0030	.0001	.09	.0430	.7000
Mar. 7	8	Distinct slight scum.	0.65	Distinctly vegetable and unpleasant.	Decidedly disagreeable.	3.95	1.00	2.95	.0440	.0240	.0210	.0030	.34	.0030	.0001	.05	.1000	.4120
April 5	5	Distinct.	0.20	Distinctly vegetable and unpleasant.	Decidedly vegetable and disagreeable.	2.15	0.90	1.25	.0022	.0281	.0172	.0112	.37	.0030	. . .	.00	.0100	.2680
May 7	5	Distinct.	0.65	Decidedly vegetable and unpleasant.	Decid. veg., grassy and unpleasant.	3.15	1.05	1.65	.0026	.0320	.0168	.0122	.39	. . .	. . .	0.2	.0360	.5904
June 10	6	Distinct green.	1.20	Distinctly vegetable and unpleasant.	Distinctly vegetable and sweetish.	3.95	2.15	1.80	.0254	.0416	.0272	.0164	.41	.0070	.0002	0.3	. . .	.7161
July 10	11	Decided green.	1.20	Distinctly vegetable and unpleasant.	Decidedly vegetable sweet and grassy.	3.85	2.15	1.70	. . .	.0562	.0316	.0246	.48	. . .	. . .	0.3	. . .	.7762
Aug. 5	9	Decided green.	1.30	Decidedly sweet corn, grassy, etc.	Decidedly sweet corn.	4.75	2.50	2.25	.0014	.1268	.0370	.0898	.45	. . .	. . .	0.8	. . .	1.1040
Sept. 11	12	Distinct green.	1.30	Distinctly vegetable and sweetish.	Decid. veg., sweet corn and grassy.	4.00	1.80	2.20	.0060	.0720	.0480	.0240	.45	.0020	. . .	0.8	.0500	1.0087
Oct. 9	10	Distinct.	0.80	Faintly vegetable.	Faintly vegetable.	4.45	2.90	1.55	.0082	.0571	.0434	.0140	.41	. . .	.0002	0.5	.0530	.7070
Nov. 12	13	Very slight.	0.80	Decidedly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	3.95	2.20	1.75	.0132	.0393	.0362	.0034	.47	.0070	.0001	0.5	.0185	.7578
Dec. 10	11	Very slight.	0.62	Decidedly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	3.90	1.85	2.05	.0010	.0384	.0280	.0193	.44	.0030	.0001	0.3	.0100	.6868

ANALYSIS OF WATER IN BREED'S POND BY STATE BOARD OF HEALTH.

PART I IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.				AMMONIA.			NITROGEN AS						
Collection.	Examination.	Turbidity.	Sediment.	Cold.	Hot.	Color.	Total.	Loss on Ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Chlorine.	Nitrates.	Nitrites.	Hardness.	Iron.	Oxygen consumed.
Jan. 3 Jan.	4 Slight.			Distinctly vegetable and unpleasant.	0.49		Faintly vegetable.	3.75	1.65	3.55	0.000	0.035	0.005	0.060	0.000	0.000	0.000	0.000	0.000
Feb. 7 Feb.	5 Distinct.			Distinctly vegetable and unpleasant.	0.50		Decidedly vegetable and unpleasant.	3.80	1.30	3.50	0.002	0.012	0.002	0.010	0.000	0.003	0.000	0.010	0.072
Mar. 7 Mar.	5 Slight acum.			Distinctly vegetable and unpleasant.	0.60		Decidedly vegetable and unpleasant.	3.35	1.45	1.00	0.004	0.004	0.005	0.004	0.000	0.000	0.000	0.007	0.580
April 5 April	5 Slight.			Faintly vegetable.	0.60		Distinctly vegetable.	3.70	1.40	3.30	0.004	0.004	0.005	0.005	0.000	0.000	0.000	0.009	0.536
May 7 May	5 Slight.			Decidedly vegetable.	0.55		Decidedly vegetable	3.75	1.65	3.10	0.006	0.006	0.007	0.000	0.000	0.000	0.000	0.030	0.665
June 6 June	6 Distinct.			Faintly vegetable.	0.63		Distinctly vegetable and sweetish.	3.65	1.60	3.35	0.008	0.008	0.004	0.000	0.000	0.000	0.000	0.000	0.5300
July 10 July	11 Very slight.			Distinctly vegetable.	0.55		Distinctly vegetable and sweetish.	3.25	1.25	2.00	0.007	0.007	0.008	0.000	0.000	0.000	0.000	0.000	0.5428
Aug. 5 Aug.	9 Distinct green			Distinctly vegetable and sweet.	0.53		Distinctly vegetable and sweetish.	3.65	1.35	2.30	0.010	0.005	0.007	0.000	0.000	0.000	0.000	0.000	0.5000
Sept. 11 Sept.	12 Slight green.			Faintly vegetable.	0.70		Distinctly vegetable.	3.60	1.45	2.15	0.008	0.008	0.004	0.006	0.000	0.000	0.000	0.030	0.4389
Oct. 9 Oct.	10 Slight.			Distinctly vegetable and grassy.	0.65		Distinctly vegetable and unpleasant.	3.70	1.45	2.25	0.014	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.4446
Nov. 12 Nov.	13 Very slight.			Distinctly vegetable and grassy.	0.70		Distinctly vegetable and unpleasant.	3.40	1.15	2.25	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.0415	0.4914
Dec. 10 Dec.	11 Very slight.			Distinctly vegetable.	0.60		Distinctly vegetable	4.20	1.55	2.65	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.0075	0.5641

ANALYSIS OF WATER IN GLEN LEWIS POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	APPEARANCE.		ODOR.		RESIDUE ON EVAPO- RATION.			AMMONIA.		NITRO- GEN AS		Oxygen consumed.						
	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.		In suspension.	Chlorine.	Nitrates.	Nitrites.	Hardness.	Iron.
Jan. 4	Distinctly green.	Slight.	0.8	Decidedly vegetable and unpleasant.	Decidedly vegetable and unpleasant.	4.65	2.00	2.65	.0004	.0528	.0264	.0264	.50	..	..	0.8	.0100	5866
Feb. 7	Distinct cons. scum.	Slight.	0.70	Decidedly aromatic.	Decidedly aromatic and unpleasant.	3.95	1.85	2.10	.0240	.0354	.0228	.0126	.49	.0030	.0001	0.9	.0430	7000
Mar. 7	Distinct slight scum.	Considerable.	0.65	Distinctly vegetable and unpleasant.	Decidedly disagreeable.	3.95	1.00	2.95	.0440	.0240	.0210	.0030	.34	.0030	.0001	0.5	.1000	4180
April 5	Distinct.	Considerable.	0.20	Distinctly vegetable and unpleasant.	Decidedly vegetable and disagreeable.	2.15	0.90	1.25	.0022	.0284	.0172	.0112	.37	.0030	..	0.0	.0100	2980
May 7	Distinct.	Cons. green.	0.65	Decidedly vegetable and unpleasant.	Decid. veg., grassy and unpleasant.	3.45	1.05	1.65	.0026	.0320	.0168	.0122	.39	..	..	0.2	.0360	5904
June 6	Distinct green.	Cons. green.	1.20	Distinctly vegetable and unpleasant.	Distinctly vegetable and sweetish.	3.95	2.15	1.80	.0254	.0436	.0272	.0164	.41	.0070	.0002	0.3	..	7161
July 10	Decided green.	Cons. green.	1.20	Distinctly vegetable and unpleasant.	Decidedly vegetable sweet and grassy.	3.85	2.15	1.70	..	.0562	.0316	.0246	.48	..	..	0.3	..	7702
Aug. 8	Decided green.	Slight green.	1.30	Decidedly sweet corn, grassy, etc.	Decidedly sweet corn.	4.75	2.50	2.25	.0014	.1268	.0370	.0898	.45	..	..	0.8	..	11049
Sept. 11	Distinct green.	Cons. scum.	1.30	Distinctly vegetable and sweetish.	Decid. veg., sweet corn and grassy.	4.00	1.80	2.20	.0060	.0720	.0480	.0240	.45	.0020	..	0.5	.0500	10087
Oct. 9	Distinct.	Considerable.	0.80	Faintly vegetable.	Faintly vegetable and unpleasant.	4.45	2.09	1.55	.0082	.0574	.0434	.0140	.44	..	.0002	0.5	.0325	7076
Nov. 12	Very slight.	Slight.	0.80	Decidedly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	3.95	2.20	1.75	.0132	.0362	.0362	.0034	.47	.0070	.0001	0.5	.0185	7878
Dec. 10	Very slight.	Slight.	0.62	Decidedly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	3.90	1.85	2.05	.0010	.0384	.0280	.0104	.44	.0030	.0001	0.3	.0100	6868

ANALYSIS OF WATER IN SAUGUS RIVER BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF COLLECTION.	EXAMINATION.	Turbidity.	Sediment.	Color.	ODOR.	RESIDUE ON EVAPORATION.										Oxygen consumed.				
						Total.	Loss on ignition.	Fixed.	Free.	AMMONIA.		NITRO-GEN AS								
										Albuminoid.	In suspension.	In solution.	Total.	Chlorine.	Nitrates.		Nitrites.	Hardness.	Iron.	
Feb. 7	Feb.	8	Very slight.	Slight.	0.05	Distinctly vegetable	Distinctly vegetable	4.75	1.80	2.95	.0212	.0142	.0134	.0018	.57	.0120	.0001	1.6	.0085	.0085
Mar. 7	Mar.	8	Very slight	Cons. brown.	1.10	Decidedly vegetable and sweetish.	Decidedly vegetable and sweetish.	5.75	2.55	3.20	.0014	.0244	.0218	.0026	.55	.0030	. . .	.23	.0125	.0720
April 5	April	5	Slight.	Cons. reddish brown flk.	0.40	Faintly vegetable.	Faintly vegetable.	5.00	1.30	3.70	.0005	.0136	.0112	.0024	.59	.0130	. . .	1.5	.0110	.3666
May 7	May	8	Slight.	Considerable.	1.90	Decidedly vegetable and grassy.	Decidedly vegetable and sweetish.	6.85	3.10	3.75	.0010	.0314	.0286	.0028	.74	.0030	.0001	2.2	.0400	1.3653
June 6	June	6	Very slight	Slight.	1.45	Distinctly vegetable	Distinctly vegetable and mouldy.	6.80	2.84	3.95	.0020	.0260	.0250	.0016	.50	.0070	. . .	.23	. . .	1.1011
July 10	July	11	Very slight.	Slight.	1.20	Distinctly vegetable	Distinctly vegetable mouldy to musty.	5.60	3.00	2.60	.0015	.0280	.0270	.0006	.70	. . .	.0001	3.5	. . .	.0001
Aug. 8	Aug.	9	Slight.	Slight brown.	1.00	Decidedly vegetable mouldy and straw	Decidedly vegetable mouldy and straw	9.30	3.00	0.30	.0045	.0340	.0284	.0050	.24	.0030	. . .	.44	. . .	.7007
Sept. 11	Sept	12	Slight.	Slight brown.	.0200	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	10.00	3.40	6.60	.0030	.0280	.0250	.0030	.20	. . .	.0001	5.1	.0010	.0337
Oct. 9	Oct.	10	Slight.	Slight.	0.90	Dist. veg., sweetish next day stronger	Distinctly vegetable and sweetish.	8.55	3.45	5.10	.0000	.0310	.0285	.0052	.70	. . .	. . .	.47	.0175	.7530
Nov. 12	Nov	13	Very slight.	Slight.	1.50	Distinctly vegetable and unpleasant.	Distinctly vegetable and sweetish.	9.00	1.00	8.00	.0015	.0360	.0372	.0024	.75	. . .	. . .	3.4	.0105	1.7316
Dec. 10	Dec.	11	Very slight.	Very slight.	1.90	Decidedly vegetable and sweetish.	Decidedly vegetable and sweetish.	10.40	4.65	5.75	.0002	.0430	.0412	.0024	.70	.0020	. . .	4.6	.0200	1.7710

TABLE 1.

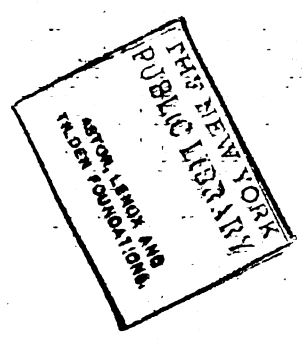
SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING
DECEMBER 31, 1894.

MONTH.	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
	Gallons.	Gallons.	Gallons.	Gallons.	Galls.	Galls.
January	114,973,076	3,708,809	175,041	. . . . .	53.44	55.36
February	108,636,460	3,879,874	171,065	. . . . .	55.91	57.92
March	117,004,958	3,774,353	. . . . .	105,521	54.39	56.34
April	112,135,702	3,737,857	. . . . .	36,496	53.86	55.80
May	116,499,913	3,758,062	20,205	. . . . .	54.15	56.10
June	128,868,740	4,295,624	537,562	. . . . .	61.90	64.12
July	151,397,076	4,883,777	588,153	. . . . .	70.37	72.90
August	134,359,973	4,334,193	. . . . .	540,584	62.45	64.70
September	130,874,061	4,362,460	28,276	. . . . .	62.86	65.12
October	123,768,047	3,922,518	. . . . .	439,951	56.52	58.55
November	110,574,561	3,685,819	. . . . .	236,699	53.11	55.02
December	118,333,195	3,817,135	131,316	. . . . .	55.00	56.98
Totals and averages	1,467,425,762	4,020,344	. . . . .	. . . . .	57.85	59.90

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1894.

MONTH.	BREED'S.	BIRCH.	CANAL.	Total.
	Gallons.	Gallons.	Gallons.	Gallons.
January . . . . .	.....	.....	116,463,165	116,463,165
February	7,631,112	.....	100,254,688	107,885,800
March	18,582,190	.....	101,321,110	119,903,400
April	10,318,330	.....	92,864,970	103,183,300
May	9,626,540	29,636,200	86,638,860	125,901,600
June	31,137,530	6,566,560	91,164,650	128,868,740
July	49,937,767	82,287,480	18,532,041	150,757,288
August	9,645,350	126,256,802	.....	135,902,152
September	655,215	124,368,585	.....	125,023,800
October	76,425,030	48,327,070	.....	124,752,100
November	38,003,279	42,637,835	31,298,426	111,939,540
December	46,975,775	70,731,870	117,707,645
Total	298,038,118	460,080,532	709,269,780	1,468,288,430



15
15
13
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TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1894.

MONTH.	BREED'S.	BIRCH.	CANAL.	Total.
	Gallons.	Gallons.	Gallons.	Gallons.
January . . . . .	.....	.....	116,463,165	116,463,165
February	7,631,112	.....	100,254,688	107,885,800
March	18,582,190	.....	101,321,110	119,903,400
April	10,318,330	.....	92,864,970	103,183,300
May	9,626,540	29,636,200	86,638,860	125,901,600
June	31,137,530	6,566,560	91,164,650	128,868,740
July	49,937,767	82,287,480	18,532,041	150,757,288
August	9,645,350	126,256,802	.....	135,902,152
September	655,215	124,368,585	.....	125,023,800
October	76,425,030	48,327,070	.....	124,752,100
November	38,003,279	42,637,835	31,298,426	111,939,540
December	46,975,775	.....	70,731,870	117,707,645
Total	298,038,118	460,080,532	709,269,780	1,468,288,430

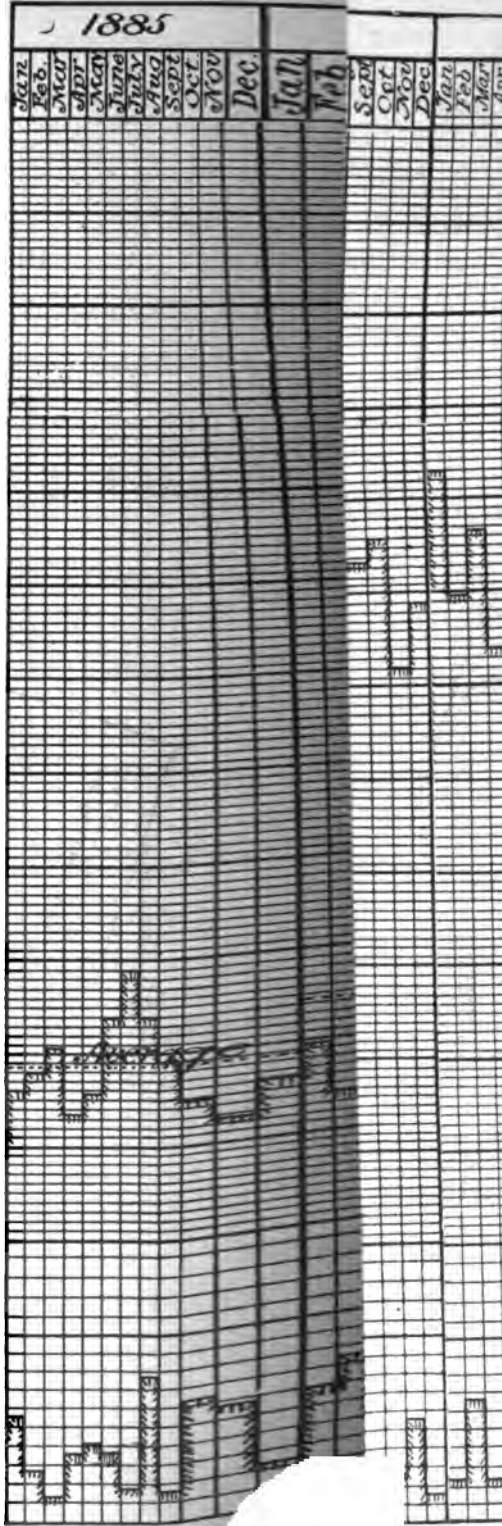
1885

GALLONS.

160,000,000
150,000,000
140,000,000
130,000,000
120,000,000
110,000,000
100,000,000
90,000,000
80,000,000
70,000,000
60,000,000
50,000,000
40,000,000

INCHES.

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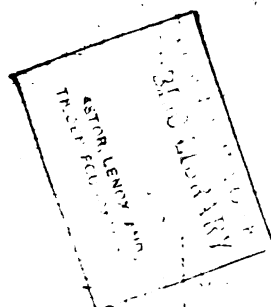


TABLE III.

SHOWING THE RAINFALL AT THE PUMPING STATION FOR 1894.

Day of Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1.	.	*0.01	.	.	.	.	.	.	.	.	.	*0.45
2.	.	.	.	.	.	0.15	0.05	.	.	.	.	.
3.	.	.	.	.	.	0.01	0.20	0.22	.	0.04	0.45	.
4.	.	.	.	0.43	0.22	.	.	.	.	0.37	.	.
5.	0.06	*0.13	.	.	0.29	.	.	.	0.10	.	*1.67	.
6.	*0.04	.	.	0.03	0.05	0.02	.	.	.	.	.	.
7.	.	.	.	*0.58	.	.	.	.	.	.	.	.
8.	.	.	.	*0.48	.	.	.	0.23	0.48	0.26	*0.27	*0.35
9.	*0.22	0.40	0.01	*0.01	.	.	.	0.28	.	0.18	0.33	*0.23
10.	*0.22	0.42	.	.	.	.	.	.	.	1.82	0.08	.
11.	*0.07	.	0.01	*0.92	.	.	.	0.22	.	.	.	0.33
12.	.	*0.61	.	0.36	.	.	.	0.03	.	.	.	0.40
13.	.	*0.02	0.11	0.16	.	.	.	.	.	1.20	.	.
14.	.	*0.37	0.09	.	.	.	.	.	0.03	.	0.12	.
15.	0.18	0.41	0.03	.	.	.	.	0.04	0.04	.	.	.
16.	.	.	.	.	.	.	.	.	0.06	.	.	.
17.	.	0.03	.	.	0.02	.	.	.	0.14	.	0.05	.
18.	0.11	0.13	.	.	0.92	.	.	.	.	.	0.03	.
19.	.	0.20	.	.	0.09	.	.	1.30	.	.	.	.
20.	.	.	.	0.03	.	.	.	0.02	.	.	.	.
21.	.	.	0.01	0.10	.	0.40	0.68	.	.	.	0.12	.
22.	.	0.30	.	.	.	.	.	.	.	.	.	.
23.	.	0.26	.	.	0.25	.	0.88	.	.	.	.	.
24.	0.36	.	.	0.26	1.50	.	0.53	.	.	.	.	0.17
25.	.	0.03	.	.	.	.	0.52	.	.	1.43	*0.12	.
26.	*0.32	*0.01	.	.	0.01	.	.	.	.	.	.	*1.06
27.	*0.30	.	.	.	.	.	.	.	.	.	.	1.24
28.	.	.	0.01	.	0.38	.	.	.	.	.	.	*0.02
29.	0.88	.	0.16	.	0.37	0.01	0.12	.	0.01	0.23	.	.
30.	*0.30	.	.	.	0.48	.	.	.	0.26	*0.10	.	.
31.	.	.	.	.	0.30	.	.	.	.	.	.	.
Total . .	2.84	2.74	1.11	3.33	4.91	0.59	2.98	2.56	2.18	5.79	3.34	4.25

Total for the year 36.62.

* Snow.

TABLE IV.

SHOWING THE RAINFALL AT CITY HALL FOR 1894.

Day of Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1												
2						.16	.03					.40
3							.18					
4		*.13		.40	.24					.01	.31	
5					.27				.09			
6	*.09			.01	.07						*1.39	
7				.50								
8				.25								
9		*.35						.31	.47	.27	.25	.25
10	*.17	*.35						.29		.25	.38	*.18
11				.85						1.65	.04	
12		*.05		.27				.18				.27
13			.11	.11				.03		1.00		.36
14		*.48							.02			
15	.20	.32	.03					.04				
16												
17		.02			.02				.15		.08	
18	.13	.09			.90							
19		.20			.05				1.15			
20					.04			1.10				
21				.09		.27	.75				.11	
22			.43									
23			.13		.15		.79					
24	.32			.20	1.57		.04					.15
25			.02				.43			1.33	.07	
26	*.19											*.59
27	*.10											1.06
28					.24							*.02
29			.14		.21	.07	.12					
30	*.85				.40					.22	.07	
31	*.07				.27					.27		
Total . .	2.21	1.99	.86	2.68	4.43	.50	2.34	1.95	1.88	5.00	2.70	3.28

Total rainfall, 29.82.

* Snow.

TABLE V.
SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING 1894

DATE.		Breed's Pond.	Walden Pond.	Glen Lewis Pond.	DATE.		Breed's Pond.	Walden Pond.	Glen Lewis Pond.
		Feet.	Feet.	Feet.			Feet.	Feet.	Feet.
Jan. 1	11.4	7.3	16.4	10.4	May 7	19.0	22.3	15.3	13.5
Jan. 8	12.4	7.0	16.4½	10.4½	May 14	19.8½	22.2½	15.3	13.6
Jan. 15	12.2	7.11	16.3	10.3	May 21	19.9	22.3½	15.3	13.8
Jan. 22	12.7	8.3	15.1	9.11	May 28	20.3	22.5½	14.10½	14.5
Jan. 31	13.5	8.11	15.9	9.9	June 4	20.9½	22.10	14.4½	14.11
Feb. 7	13.8	9.1	15.8	9.8	June 11	21.2½	22.10	12.8	15.5
Feb. 12	14.3	10.3	15.3	9.3	June 18	20.11½	22.10	10.8	15.6
Feb. 19	15.1½	13.5½	14.7	8.7	June 25	20.5	22.7	8.3	15.6
Feb. 26	15.8	16.4½	13.6	7.6	June 30	19.5	22.3½	6.	15.6
Mar. 2	15.6	17.9½	13.3	7.	July 7	19.1	22.3	5.4	15.6
Mar. 7	15.9	18.10	13.3½	7.5	July 14	17.11	22.	5.4	15.5½
Mar. 12	16.4	19.3	13.11½	9.2	July 16	16.10½	21.1½	5.4	15.4
Mar. 19	17.5½	19.3	14.3½	9.9	July 23	16.6	20.5	5.4	15.5
Mar. 26	17.9	19.4½	14.6	10.3	July 30	16.8	19.1	5.4	15.5
Apr. 2	17.9	19.5	14.6	10.6½	Aug. 6	16.4	17.11	5.4	15.5
Apr. 8	18.1	20.6	14.6	10.8½	Aug. 13	16.1	16.10½	5.4	15.4
Apr. 14	18.9	21.6	14.4	10.8½	Aug. 20	16.1	15.7½	5.4	15.3½
Apr. 21	19.5½	22.6½	14.11	12.0½	Aug. 27	16.½	14.4½	5.4	15.2½
Apr. 28	19.7½	22.6½	15.2½	13.2½				5.4	15.6

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1894.

STREET.	LOCATION.
Adams	On line south side Chestnut street, 17.5 feet west of east side.
Elvir	On line east side Eastern avenue, 17 feet east of west side.
Estes	On line east side Howard street.
Lander	On line south side Chestnut street, 17.6 feet west of east side Lander street.
Rock avenue . .	On line north side of E. Hollingsworth street, 17 feet west of east side Rock avenue.
Tremont	On line south side Market street, 11.6 feet west of east side Tremont street.

TABLE VII.

SHOWING THE LOCATION OF HYDRANTS SET IN 1894.

STREET.	LOCATION.
Boston	Opposite North Bend street.
Grant	Corner of Rockingham street.
Elvir	445 feet north of Eastern avenue.
Essex	Corner Essex avenue.
Holyoke	Opposite Emergency Hospital.
Mt. Vernon . . .	268 feet north of Exchange street.
Sumner	36 feet east of Sumner place.
Tremont.	315 feet east of Pleasant street.
Union	212 feet north of Silsbee street.
Walnut	Saugus line.

TABLE VIII.

SHOWING THE LEAKS IN PIPES AND HYDRANTS.

MONTH.	SIZE OF MAINS.							
	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	Hyd.
January	1	...	...	2	2	1
February	1	2
March	1	...	...	1	3	1
April	1	1	...	1	2	2
May	2	4	10	1
June	2	1	...
July	2	5	3	1
August	1	...	...	...	3	2	7	1
September	3	9	1
October	7	...	...
November	1	1	4	13	1
December	2	2
	1	...	3	2	8	31	54	13

TABLE IX.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE IN 1894.

KIND.	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	3	4	Total
Thompson "Bee"		52	182	30						264
Thompson		48	67	42		12	2	1	1	173
Ball & Fitts.		40	55	19		2				115
Trident		41	49	5						95
Worthington		7	18	27	3	2	13	1		71
Union			14	15		7	10		15	61
Neptune		20	17	6		1	2			46
Crown	1		11	6		2				20
Hersey		3	11			1				15
Weir	1		3	5		4				13
Nash		2	3	1						6
Empire							4			4
Niagara				2						2
Frost			1							1
Gem							1			1
Columbia		1								1
Motors										2
Totals	2	214	431	158	3	30	32	2	16	890

Total gallons metered, 195,716,250.

TABLE X.
SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICES LAID IN 1894.

MONTH.	SIZE AND LENGTH OF PIPE.																Total.	
	6 in.		4 in.		2½ in.		2 in.		1½ in.		1¼ in.		1 in.		¾ in.			
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.		
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.		
January	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
February	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
March	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
April	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
May	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
June	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
July	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
August	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
September	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
October	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
November	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
December	1	16.6	1	32.9	1	157.3	1	1,098.2	2	100.2	1	231	1	880.6	25	778.6	44	2,004.3
Totals	4	100.10	5	119.1	1	157.3	4	1,173.3	5	788.8	6	796.6	143	6,436.2	150	5,263.4	318	14,815.1

TABLE XI.

SHOWING THE AMOUNT AND SIZE OF CAST-IRON PIPE LAID IN 1894.

WHERE LAID.	10 in.	8 in.	6 in.	4 in.
Adams street			193	
Bailey street				166
Clovelly street			216	
Coburn street				68
Grant street			259	17
Elvir street			486	
Hillside avenue			132	
Huron street				217
Holyoke street			599	
James street				*36
Lander street				245
Lander avenue				41
Lookout terrace			52	191
Mt. Vernon street		*580	*9	
Pleasant street		*196		
Rock avenue			194	
Stewart street			*622	
Tudor street			*763	
Tremont street		*711		
Union street	*2,135			
Waterford street				100
Williams street				100
Walnut street			558	
Wenuchus street				172
Totals	2,135	1,487	4,083	1,353

* Relaid.

TABLE XII.

SHOWING THE AMOUNT AND SIZE OF CEMENT-LINED PIPE LAID IN 1894.

WHERE LAID.	2 in.	1½ in.	1¼ in.	1 in.
Caldwell crescent	290	.....	.....	.....
Gerrish place . . . . .	.....	.....	.....	100
Essex terrace . . . . .	.....	.....	145	.....
Hancock street . . . . .	.....	.....	88	.....
Hamilton street . . . . .	.....	.....	100	.....
Ocean place . . . . .	.....	.....	92	.....
Ocean avenue . . . . .	.....	160	.....	.....
Reservoir road	280	.....	.....	.....
Richardson court . . . . .	.....	.....	198	.....
Totals	570	160	623	100

	MILES.	FEET.
Total cement-lined pipe laid in 1894		1,453
Total pipe laid in 1894		9,058
Cement pipe taken up and replaced with cast-iron pipe		5,052
Total extension		4,006
Previously laid	106	2,062
Private pipe in Swampscott		1,788
Pipe in Saugus	14	4,880
Total supplied by the works	121	3,450

TABLE XIII.

RECORD OF THE LEAVITT ENGINE FOR THE YEAR ENDING DECEMBER 31, 1894.

DATE.	Month.	Days	Number of pumping days.	Total pumping time per month.		Average pumping time per day.	Number of revolutions per month.	Rev.	Average revolutions per minute.	COAL CONSUMED.						Gallons pumped per month.	Average number of gals. pumped per lb. of coal.	Average number of gal. ions raised 100 feet high per pound of coal.	Average head against the pump.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, no deduction for ashes.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, the ashes deducted.	Oil.	Waste.
				Raising steam.	Pumping.					Banking.	Total.	ashes.											
		H. M.	H. M.							Lbs.	Lbs.	Lbs.	Lbs.	P. ct.	Gals.	Gals.	Gals.	Feet.	Lbs.	Lbs.	Gals.	Lbs.	
January	January	27	569.30	21.50			624,300	18.27	3.100	142,700	1,200	147,000	17,350	11.69	116,463.165	792.7	1.283	161.86	106,949.027	121,351.374	30.	25	
February	February																					12	
March	March																					10	
April	April																					10	
May	May																					10	
June	June	28	626.35	22.22			690,800	18.37	1.500	156,000	600	158,100	14,595	9.20	128,868.720	815.1	1.209	159.48	108,414.654	119,440.834	38.	25	
July	July	1	12.12				13,250	18.40		2,800		2,800	2,800	18.57	2,471.788	882.7	1.431	161.30	118,755.465	145,340.045	60.5	15	
August	August	4	64.15	16.03			73,550	19.07	900	15,600	400	16,900	1,200	7.10	13,720.753	811.8	1.266	158.41	107,260.599	115,458.794	5.	15	
September	September																						
October	October																						
November	November	17	351.35	20.41			380,800	18.08	1.500	88,700	600	90,900	7,030	8.61	71,038.240	782.3	1.268	160.86	104,843.720	115,002.917	20.	15	
December	December	7	153.40	21.57			163,900	17.77	400	38,100	400	38,900	3,520	8.98	30,575.545	786.	1.260	160.31	105,067.550	111,514.241	9.	15	
Totals and Averages.	Totals and Averages.	84	1,777.35	21.09			1,946,600	18.25	7,500	443,900	3,200	454,600	45,115	9.85	363,138.230	798.8	1.282	160.56	106,966.048	118,809.058	103.5	165	

SUMMARY OF STATISTICS.

Report of 1894.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1890,

Lynn and Saugus,

59,400

Date of construction,

1870 to 1872

Owned by,

City of Lynn.

Source of supply,

Four artificial storage basins, formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co., of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 10,000,000 daily capacity.

1. Kind of coal used,

Pocahontas.

2. Cost of coal,

\$4.50, \$4.00, \$3.65 (2,000 lbs.) delivered.

3. Coal consumed for the year, in pounds,

Leavitt.

Loretz.

454,400

1,426,800

4. Pounds of wood consumed in pounds coal,

200

900

	Leavitt.	Loretz.
5. Total consumed for the year (3)+(4),		
	454,600	1,427,700
6. Total pumpage for the year, in gallons,		
	363,138,230	1,105,150,200
7. Average dynamic head against which pump works,		
	160.53	159.82
8. a. Number of gallons pumped per pound of coal (3)+(4),		
	798.80	774.70
b. Number of gallons raised 100 feet per pound of coal (3)+(4),		
	1,282.55	1,238.12
9. Duty, in foot pounds per 100 pounds of coal, no deductions,		
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed}}$		
	106,966,048	103,176,674

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$9,249.22.

10. Per million gallons raised against average dynamic head (7) into reservoir,	\$5.29
11. Per million gallons raised one foot high (dynamic),	3.93 cents

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ :
\$124,607.92.

12. Per million gallons raised against dynamic head (7) into reservoir,	\$84.86
13. Per million gallons raised one foot high (dynamic),	52.91 cents

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
<i>From Consumers:</i>			
A. Water rates, domestic,	\$134,306.91	AA. Management and repairs,	\$47,449.30
B. Water rates, manufacturing,	37,143.25	BB. Interest on bonds,	77,158.62
C. Net receipts, for water,	\$171,450.16	CC. Total maintenance,	\$124,607.92
D. Repairs and sundries,	1781.57	DD. Balance carried to sinking fund,	52,047.58
E. Gross receipts from all sources,	\$173,231.73	EE. Total,	\$173,231.73

CONSTRUCTION.

RECEIPTS.		EXPENDITURES.	
F. From balance of 1893,	\$38,438.19	FF. Extension of main lines,	\$8,092.02
G. Pipes, meters and labor,	11,632.11	GG. Extension of service pipes,	7,291.11
		HH. Meters,	2,433.88
		II. Account ponds, Saugus river and land bought,	4,774.50
		JJ. Total construction for year,	\$22,591.51
		LL. Balance,	27,606.62
H. Total,	\$50,198.13	MM. Total,	\$50,198.13

1. Net cost of works to date	.	\$2,107,289.75
J. Bonded debt, Dec. 31, 1893	.	1,615,300.00
K. Value of sinking fund	.	266,699.67
L. Rate of interest	.	34, 34, 4, 44, 5, 6

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	69,400
Estimated population supplied,	66,990
Total number of gallons consumed for the year,	1,467,425,762
No. of gallons metered,	195,716,250
Average daily consumption in gallons,	4,020,344
Gallons per day to each consumer,	60

DISTRIBUTION.

Kind of pipe used,	Wrought iron cement-lined and cast-iron
Size,	From 2 to 20 inches in diameter
Extended,	4006 feet
Total now in use,	107 miles, 768 feet
Total now in use,	Lynn, Saugus, Swampscott, 121 miles, 3,450 feet
Number of leaks for the year,	99
Hydrants added,	10
Hydrants now in use,	783
Gates added,	6
Gates now in use,	920
Range of pressure of city for day and night,	50 to 65 pounds

SERVICES.

Kind of pipe used,	iron, cement-lined adamanta and galvanized iron
Size of pipe used,	3 to 10 inches in diameter
Extended,	16,305
Discontinued,	3,140
Number of services added,	318
Number of services discontinued,	68
Number of services now in use,	10,827
Total length of services,	87 miles, 3,067 feet
Number of services added in Saugus,	81
Number of services now in use in Saugus,	607
Length of services added in 1894,	3,932
Total length of services in Saugus,	5 miles, 5,037 feet
Meters added,	221
Meters now in use,	890



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ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1895.



LYNN, MASS. :
WHITTEN & CASS, PRINTERS
1896

V. D. A. R. t.

ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1895.



LYNN, MASS.:
WHITTEN & CASS, PRINTERS
1896

1896

OFFICERS FOR 1895.

DAVID KNOX,
For one year.

D. A. SUTHERLAND,
For two years.

JOHN MCNAIR,
For three years.

THOS. P. NICHOLS,
For four years.

W. B. LITTLEFIELD, *Pres.*
For five years.

Superintendent and Clerk, JOHN C. HASKELL

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, G. S. SANBORN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. MCCLAIN.

Inspectors { WINSLOW J. ROWELL,
J. FRANK POOL,
W. B. MOULTON,
JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1896.

D. A. SUTHERLAND, for one year.

JOHN MACNAIR, for two years.

THOS. P. NICHOLS, for three years.

W. B. LITTLEFIELD, *Pres.*, for four years.

CHAS. O. BEEDE, for five years.

ANNUAL REPORT

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1896. }

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-fourth annual report, together with the reports of the Superintendent and Registrar.

Water Supply.

At a time when efforts are being made to include the city of Lynn in a metropolitan district, or what is liable to become a step towards being included in a greater Boston, and believing that it is not to the advantage of Lynn to be included in the proposed county, as we are on the extreme outside edge and isolated from Boston by miles of salt marshes, which cannot be utilized even for residential purposes without great expense. It has been already shown from our experience with the Metropolitan Park Commission, that the benefits to be received are slight as compared to the assessments that have been levied upon our citizens to pay for work done by the Commission. Last year a bill was introduced in the Legislature, framed by the State Board of Health, in which Lynn was included in a metropolitan water-supply district, thereby giving an opportunity for the expression of the opinion of the citizens of Lynn in this direction, which was voiced by the unanimous passage of an order by the City Council as follows:

March 5, 1895.

Ordered, That the City Solicitor be and hereby is instructed to appear before the Committee on Metropolitan Affairs and Water Supply, and oppose the taxing the city of Lynn for any part of the expense of taking the Nashua river.

Through the efforts of our senator and the representatives from this district, the city of Lynn was left out of the bill as adopted by the Legislature. One of the principal arguments used in the different cities and towns to influence public opinion and sentiment in that direction is the great desirability of the proposed metropolitan water supply. We will present a brief description of our present supply and the possibilities of the future.

The construction of our system of water supply was commenced in 1870. The first source of supply was Breed's pond, which, when full, has twenty-two feet of water at the dam. It contains 58.45 acres of water surface, a total storage capacity of 262,563,340 gallons, a water-shed, including pond surface, of .93 square miles.

In 1873, Birch pond was added by constructing a dam across the valley of Beaver brook, supplied by a water-shed of .66 square miles.

On June 23, 1883, the city was authorized to take the waters of Hawkes and Penney brooks, tributaries of Saugus river, and whenever the flow of water in the river should exceed 15,000,000 gallons per day, the excess over said 15,000,000 gallons may be diverted for the use of the city. In the fall of 1883 work was commenced by constructing a canal and tunnel between Saugus river at Howlett's mill and Birch pond, connecting Hawkes and Penney brooks, separately, to the main canal, and laying a pipe through the bottom of Birch pond. This work reached completion the following year.

In 1884, Birch pond dam was raised nine feet to its present height, giving 21.50 depth of water at dam, and a pond surface of eighty-two acres, with a drainage area, including the pond, of .66 square miles, a total storage capacity of 381,062,901 gallons. During the year the pipe lines leading from Breed's and Birch ponds to the pumping station were connected.

In 1886, a pumping station was erected at the upper end of Birch pond over the canal, equipped with a steam engine and boiler of sixty-horse power, and a Webber fifteen-inch centrifugal pump capable of pumping 12,000,000 gallons of water daily from the canal into the pond. This became necessary in order to fill Birch and Breed's ponds when they were unable to fill from their own water-shed.

On the 12th of June, 1888, an order was passed by the City Council instructing the Water Board to construct a dam on either Hawkes brook or Penney brook. The board decided to construct a dam on Penney brook and thought it advisable to construct a second dam across an arm of Walden pond to give increased depth to the upper end. The pond was called Glen Lewis; both dams were erected in 1889. Walden pond, when full, has seventeen feet of water at dam, a pond surface of 128 acres and a water-shed, including pond surface, of 1.31 square miles, a storage capacity of 403,163,826 gallons.

Glen Lewis pond has a depth of seventeen feet, with a pond surface of thirty-six acres, a water-shed, including pond surface, of .36 square miles, and a storage capacity of 120,475,126 gallons.

The water-shed of these ponds, together with the water-shed of Hawkes brook, 1.92 square miles, make a total of 5.18 square miles, with a reservoir capacity of 1,167,265,193 gallons.

By an Act of Legislature passed May 27, 1893, authority was given to the city of Lynn to take Saugus river and its tributaries (except Lake Quannapowitt and Crystal Lake in Wakefield) as an additional water supply. This addition comprises a watershed of 22.91 square miles, with a storage reservoir of 1,167,265,193 gallons capacity and represents our present water supply.

In pursuance of the general development of our present water supply as required by increased consumption the following order was passed by the City Council :

IN BOARD OF MAYOR AND ALDERMEN, }
December 4, 1894.

Ordered, That the Water Board be and hereby is authorized to build a storage basin in Hawkes brook valley, at a cost not exceeding \$125,000, and that the same be charged to the account of Water Construction.

Under the provisions of this order an additional reservoir for the storage of surplus water in Hawkes brook valley is now being added to our supply, by constructing a dam across the valley of Hawkes brook, the fourth tributary of the Saugus river. The pond, when full, will have an area of seventy-five acres, a storage capacity of 300,000,000 gallons.

All soil above the level at which water can waste from the pond is being removed. The work of construction is being carried on under the supervision of Lucian A. Taylor, C. E., of Worcester, who has had an extensive experience both as an engineer in designing and as a contractor in executing works of this description. The good organization of the men employed and practical methods of handling the different parts of the work to the best advantage show his ability in this direction, and the city is exceedingly fortunate in having secured his services.

The work will reach completion in the summer of 1896. This additional reservoir will bring our total storage capacity to 1,467,265,193 gallons.

Duration of Supply.

Until 1894, a water-shed of 5.18 square miles supplied all water needed. In 1894 water was first taken from Saugus river; this water-shed comprises an addition of 17.73 square miles, making a total of 22.91 square miles, or more than four times our former area.

In the water-shed of 17.73 square miles, added in 1893, 8.50 square miles has less population per square mile than that of the proposed metropolitan supply, and will not be contaminated with sewerage from any city or town.

It can be provided with storage reservoirs sufficient to utilize the entire rainfall, as it becomes necessary to meet the increased consumption, principally secured by raising the dams of our present reservoirs. No reason exists why this supply should not increase in purity in the future as the reservoir attains greater age. To compare the length of time this addition will supply Lynn and Saugus with the length of time the metropolitan source will supply the metropolitan district, we will use the estimated

population given by the State Board of Health for 1895. Lynn and Saugus, 65,784; metropolitan district, 984,301, or 14.95 times greater. Additional drainage area of Lynn and Saugus, 8.50 square miles; metropolitan district, 118 square miles, or 13.88 times greater. These figures show that this additional supply will supply Lynn and Saugus for a greater length of time than the metropolitan system would supply the metropolitan district.

Purity of the Water.

Taking the standard adopted by the State Board of Health, viz. : the number of deaths from typhoid fever per 10,000 living population, we find from a table compiled from the census of 1890, showing the death rate from typhoid fever in cities in the United States with over 50,000 inhabitants, that Lynn has the least death rate of any but one of the fifty-four cities, and equally as good as that, and but one-fourth of the general average.

This exceptional low death rate shows that we have nothing to fear from the impurity of our water.

Walden Pond:

From the first year of its use, the water of Walden pond has contained various algæ growths in the summer months, in such quantities as to render the water disagreeable in taste. It was expected that as has usually been the case in newly constructed reservoirs, these periodical growths would in a few years disappear. No diminution in their numbers was found as late as the summer of 1894, at which time it became evident that to secure good potable water from this source these growths of organisms must be destroyed. In June the water of Walden pond was drawn off to give an opportunity to remove the soil from the bed of the pond. About eleven acres in the vicinity of the dam were cleaned. A portion of this area had a peaty deposit of great depth and very yielding in character. The experiment of covering this area with sand and gravel was tried, the expense being slight compared with that of removing the entire deposit, and will probably be as effectual in checking the algæ. An arm of the pond containing about thirteen acres, being

covered with but a slight depth of water, was cut off by constructing a dam across the lower end.

The bed of the pond has been burned over and was exposed to alternate freezing and thawing through the winter. The success attendant upon this effort is evident, as in 1895 the water remained a good, potable water, remarkably free from algæ growths until July 10, when it was again wasted, to permit further work in cleaning out the bed of the pond. The water became unfit for use on May 25, 1893, and May 23, 1894. In 1895 the soil and all perishable material was removed from about thirteen acres, at an expense of \$6,063.66.

It is intended to continue this work until the entire bed of the pond is improved.

High Service.

The following order was passed in the Board of Mayor and Aldermen, March 19, 1895 :

Ordered, That the Water Board are hereby instructed to construct the necessary works required to furnish additional pressure on the high service water supply and the expense of said works to be charged to account of Water Construction.

In compliance with this order a stand-pipe fifty feet in diameter and thirty-five feet in height, containing 500,000 gallons, was erected by E. Hodge & Co., of Boston. The foundations for the structure were built by James E. Manning, of Lynn. A duplicate pumping plant has been erected by A. J. L. Loretz, of Brooklyn, in the pumping station, with a daily capacity of 2,500,000 gallons in the high, or 3,000,000 gallons in the low service reservoir. The main pipe line for the high service runs from the reservoir through the Reservoir road to Linwood street, thence across private land to Tapley street, thence through Tapley, Woodlawn streets, Lovers' Leap avenue, Forest, North Franklin, Franklin streets, Western avenue, Bay View avenue, Hollingsworth street to Rockaway street.

This will give the people living in the Highlands a much improved supply.

Biological.

The biological examinations of the water have been conducted by Miss M. W. McFarlane, under the supervision of Mr. George C. Whipple. Samples are taken weekly from each of the ponds and the distributing reservoir. By these examinations the fullest knowledge of the quality of the water is gained.

Street Mains.

About one mile of cement-lined pipe has been taken out and replaced with cast-iron.

One hundred and sixty-seven bursts occurred.

It is the intention of the board to replace the cement-lined pipe with cast-iron only where the cost of maintenance approaches the interest on the cost of relaying the pipe.

Water Supply for Fire Purposes.

The city of Lynn is exceptionally well provided with a water supply for fire purposes. The water is delivered from the distributing reservoir on Pine Hill by three mains, 30-inch, 24-inch, and 16-inch respectively, to Walnut street at the pumping station. From the pumping station a 20-inch main extends through Walnut, Winter, Cedar, Mall and North Common streets, City Hall square, Central avenue to Andrew street, and through Liberty from Central avenue to Willow street. A 16-inch main from the pumping station passes through Walnut, North Federal, Marion, Centre, Elm, Summer and Andrew streets, connecting at that point with the 20-inch main, then through Central avenue and Union street to Silsbee street. A 12-inch pipe from the 30-inch main at the pumping station is laid through Walnut, Kirtland, Marion, Federal, and North Common streets, connecting with the 20-inch main at Mall street. A 12-inch main from the reservoir for the high service runs down the Reservoir road to Linwood street, thence through Tapley street, Woodlawn street, Lover's Leap avenue, Forest, North Franklin, Franklin streets, Western avenue to Washington street, where it is connected to the low service and can be used if necessary. In the business part of the city, 1,000,000 gallons per hour can be delivered if necessary.

PUBLIC WATER BOARD.

Land Purchased in 1895.

M. C. Jackson	11½ acres.
S. A. Silver	4½ acres.
A. P. Hiller	4 acres.

Statement.

FUNDED DEBT.

Funded loan Dec. 20, 1894	\$1,615,300 00
Bonds issued, 1895	165,000 00
Total	\$1,780,300 00
Bonds matured	5,000 00
Total loan	\$1,775,300 00

SINKING FUNDS.

Amount on hand Dec. 20, 1894	\$217,883 93
Received from treasurer	48,815 74
Income on investments	9,035 19
	\$275,734 86
Paid on matured bonds	10,000 00
Balance in hands of commissioners	\$265,734 86
Balance in hands of treasurer	73,541 14
Total	\$339,276 00

TREASURER'S STATEMENT.

Received from water rates	\$182,281 63
Received from premiums on bonds	9,125 00
Received from accrued interest on bonds	3,561 09
	\$194,968 27

EXPENDITURES.

Maintenance	\$53,093 39
Interest	68,333 74
	\$121,427 13
Net income	\$73,541 14

Respectfully submitted,

W. B. LITTLEFIELD,

President.

REPORT OF THE WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
Lynn, January 1, 1896. }

To Wm. B. Littlefield, Esq., President:

SIR,—I herewith present the financial condition of the department for the year ending Dec. 31, 1895.

RECEIPTS.

Fixture rates	\$130,616 93	
Meter rates	44,306 80	
Additional rates	2,665 42	
Miscellaneous rates	5,257 77	
Fines	101 60	
Total revenue		\$182,948 52
Extra pipe, etc.		4,126 12
Total receipts as per cash book		\$187,074 64

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$182,948 52
Amount outstanding, fixture rates	\$7,136 59
Amount outstanding, meter rates	2,248 21
Amount outstanding (not due), meter rates	11,273 26
	<u>20,658 06</u>
	\$203,606 58
Deduct amount due January 1, 1895	18,033 70
Revenue for year 1895	\$185,572 88
Revenue for year 1894	176,655 50
Increase	\$8,917 38

STATEMENT OF NET EARNINGS FOR 1895.

Revenue	\$185,572 88
-------------------	--------------

EXPENSES.

Interest	\$68,333 74	
Maintenance	51,147 43	
Rebate to Saugus	2,848 93	
	<hr/>	122,330 10
Net earnings		\$63,247 78

EXPENDITURES.

MAINTENANCE.

Pumping station expenses	\$9,494 07	
Salaries and office expenses	8,892 96	
Repairs on mains	7,648 44	
Repairs on services	6,819 04	
Walden pond	6,063 66	
Meters	5,469 78	
Stable and shop	2,763 79	
Pumping expenses (Birch pond)	1,169 30	
New supply	740 82	
Legal expenses	565 80	
Damages	546 86	
Engines and boilers	498 98	
Laboratory	195 75	
Engine-house	153 10	
Breed's pond	51 75	
Reservoir	50 63	
Birch pond	21 00	
	<hr/>	\$51,147 43

CONSTRUCTION EXPENSES.

Hawkes' pond	\$92,085 13	
Stand-pipe	22,676 24	
Services	6,227 69	
Mains	6,193 19	
Walden pond	1,005 30	
Meters	401 99	
Engineering	681 18	
Tubular wells	96 00	
	<hr/>	\$129,366 72
Less amount received for extra pipe, etc.		4,126 12
Net		\$125,240 60

STATEMENT

SHOWING COST OF WORKS TO JANUARY 1, 1896.

Mains, hydrants and gates	\$829,004 27
New supply and land	317,390 75
Services and courts	274,398 11
Walden and Glen Lewis ponds	183,563 42
Engines and boilers	140,327 29
Reservoirs and land	131,581 49
Hawkes' pond	94,391 65
Birch pond and land	93,471 84
Engine house and land	57,562 39
Breed's pond and land	57,135 28
Pipe conduits and land	45,293 98
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe	22,676 24
Highland service	12,431 17
Tubular wells	9,470 02
Engineering	9,246 17
Work shop and stable	2,056 97
	<hr/>
	\$2,359,078 59
Less amount received for pipe	126,648 24
	<hr/>
Total net cost	\$2,232,430 35

SERVICES.

Number of services in Lynn	11,023	
Number of services in Saugus	675	
Total	<u> </u>	11,698
Number put in during the year (Lynn)	279	
Number put in during the year (Saugus)	66	
Total	<u> </u>	345
Number extended during the year (Lynn)	20	
Number extended during the year (Saugus)	4	
Total	<u> </u>	24
Number discontinued	50	
Number not in use	70	
Turned on (new services)	275	
Turned on (re-occupied)	332	
Turned on (rates and fines paid)	4	
Shut off (for vacancy)	310	
Shut off (for non-payment)	9	
Shut off (for repairs)	80	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
CONTAINED IN THE SAME, TOGETHER WITH THE
NUMBER OF FIRE HYDRANTS, DEC. 31, 1895.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	10,341	654	10,995
Stores and shops	1,102	27	1,129
Factories	214	3	217
Offices	482	14	496
Restaurants and saloons	60		60
School-houses	47	5	52
Churches	27	5	32
Bakeries	32		32
Laundries	20		20
Engine-houses	9	3	12
Families	15,666	759	16,425
Boarding-houses	225	3	228
Faucets	28,191	1,224	29,415
Water-closets	11,753	308	12,061
Bath tubs	4,525	203	4,728
Hand hose	3,034	225	3,259
Urinals	216	4	220
Heaters	715	31	746
Stationary engines	149	2	151
Motors	25		25
Greenhouses	35	2	37
Drinking fountains	25		25
Stand-pipes, fire	16	1	17
Stand-pipes for water carts	42		42
Sewer connections	20		20
Automatic sprinklers	82	2	84
Hydrants	788	131	916

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	\$8,989 00
From January 1, 1872, to January 1, 1873	27,568 15
From January 1, 1873, to January 1, 1874	47,992 61
From January 1, 1874, to January 1, 1875	53,545 61
From January 1, 1875, to January 1, 1876	52,553 26
From January 1, 1876, to January 1, 1877	60,807 12
From January 1, 1877, to January 1, 1878	64,002 50
From January 1, 1878, to January 1, 1879	67,570 14
From January 1, 1879, to January 1, 1880	73,949 80
From January 1, 1880, to January 1, 1881	79,635 12
From January 1, 1881, to January 1, 1882	80,967 76
From January 1, 1882, to January 1, 1883	94,419 52
From January 1, 1883, to January 1, 1884	98,893 54
From January 1, 1884, to January 1, 1885	114,903 86
From January 1, 1885, to January 1, 1886	110,089 11
From January 1, 1886, to January 1, 1887	116,375 70
From January 1, 1887, to January 1, 1888	123,507 73
From January 1, 1888, to January 1, 1889	134,480 27
From January 1, 1889, to January 1, 1890	141,865 53
From January 1, 1890, to January 1, 1891	154,788 27
From January 1, 1891, to January 1, 1892	171,744 85
From January 1, 1892, to January 1, 1893	188,979 88
From January 1, 1893, to January 1, 1894	177,803 56
From January 1, 1894, to January 1, 1895	176,655 50
From January 1, 1895, to January 1, 1896	185,572 88
	<hr/>
	\$2,607,721 28

FUNDED WATER LOAN.

When Payable.	Rate Per Cent.	Amount.
Jan. 1, 1896	6	\$50,000
Mar. 25, 1896	4	100,000
Jan. 1, 1899	5	50,000
Jan. 1, 1900	5	50,000
Apr. 1, 1900	4	10,000
Jan. 1, 1901	5	50,000
Mar. 1, 1903	4	8,000
May 1, 1904	3½	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3½	66,500
Dec. 1, 1905	3½	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3½	31,000
Mar. 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3½	6,000
Apr. 1, 1916	3½	2,000
May 1, 1916	3½	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3½	6,500
June 1, 1917	3½	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
July 1, 1925	4	165,000
		<hr/>
		\$1,775,300

REPORT OF THE SUPERINTENDENT.

To William B. Littlefield, President Public Water Board :

SIR, — In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1895.

Water Supply.

On January 1, Breed's pond contained 55,000,000 gallons of water; Birch pond, 186,000,000 gallons; Walden pond, none, and Glen Lewis, 97,000,000 gallons—a total of 338,000,000 gallons, equal to 77 days' supply. In December, 1894, and January, 1895, water was pumped into Birch pond from the canal, a total of 143,000,000 gallons being deemed sufficient to fill the pond.

On July 1, Breed's and Birch ponds were full. In all of the ponds we had 851,000,000 gallons in store for the summer months, equal to 195 days' supply based on the daily consumption for 1895.

In July, 38,000,000 gallons were taken from Walden pond and Hawkes brook through the canal. On July 10, the use of water from the canal was discontinued and no water was taken from that source until November 7. The entire supply for this period was taken from Breed's and Birch ponds. On July 10 we commenced to draw off the water from Walden pond, which was allowed to waste into Saugus river. This was done to continue the work of cleaning the bed of the pond commenced in 1894. The mud and all organic matter was removed from about thirteen acres at a cost of \$6,063.66.

Weekly microscopical examinations have been continued of the top and bottom water in all our reservoirs, the water of Saugus river and the tap water at City Hall. No organisms injurious to health were found.

Future Supply.

Under your instructions surveys have been made to ascertain what water supply can be obtained for the future. From these examinations we find that the Ipswich river valley contains a watershed of thirty-four square miles, situated at a sufficient elevation to flow directly into the pump well at our pumping station by gravity. This water-shed is adjacent to the Saugus river water-shed. The water from an additional area below this point of seventeen square miles can be delivered into the Hawkes brook valley at a comparatively slight expense, and it is practicable to include a total of 96.70 square miles of the Ipswich river in our supply. This area together with our present water-shed amounts to 119.60 square miles.

The valley of the Ipswich river has few good locations for storage reservoirs, but additional storage for its waters can be supplied by constructing a new dam at Walden pond immediately below the site of the present dam with forty-five feet of water at the dam, a pond surface of 333 acres and a storage capacity of 2,800,000 gallons. It will also be necessary to construct a dam across the upper end of Glen Lewis pond with eleven feet of water at dam. To utilize this reservoir, it will be necessary to pump the water from the Hawkes brook pond elevation into the higher level.

We can also add to the storage capacity of Breed's pond by constructing a new dam immediately above the site of the present dam, with fifty-five feet of water at the dam, a pond surface of 175 acres and storage capacity of 1,628,000,000 gallons. It will also be necessary to construct a dam across a narrow valley on the west side of the pond; depth of water at dam twenty-four feet. Both of these reservoirs can be fully developed without encroaching upon any land not owned by the city of Lynn. To deliver the water of Walden pond into Breed's pond, it will be necessary to connect the two ponds by a conduit 1,300 feet in length and through a tunnel 2,700 feet in length.

The additional storage gained in these ponds and the Hawkes brook reservoir is 3,930,000,000 gallons. Total storage, 4,097,000,000 gallons.

The meadow immediately below the dam at Walden pond

affords a favorable site for the filter beds, a very important feature in securing the purest water from a surface water supply.

Canal.

The sides and bottom of the canal were thoroughly cleaned, new bridges were placed over the two overflows. Before using, the canal and tunnel were thoroughly flushed out.

Hawkes Pond.

Hawkes brook pond, the new addition to our water supply, will contain 300,000,000 gallons of water.

The pond, when full, will have a depth of water at dam of twenty-five feet; a pond surface of seventy-five acres; a watershed, including pond surface, of 1.92 square miles; length of main dam at crest, 1,350 feet; width, twenty feet; both slope two feet horizontal to one vertical; inner slope a loose riprap of about two feet in thickness; outer slope and top of dam to be covered with loam. A core wall will extend from bottom to within three feet of top of embankment; from bottom of core to top of dam will be fifty-five feet; core wall is founded in solid ledge.

There will be a wing dam 210 feet long at crest; core wall and side slope same as main dam; water at wing dam, eighteen feet; waste way will be at east of dam, five feet below crest, and will be excavated through ledge to the valley below. All soil above the level at which water can waste from the pond is being removed.

The gate house will be so arranged that water can be drawn from any desired elevation. Through the main dam there will be one 36-inch and one 30-inch pipe.

High Service.

Until the present time our high service supply has been drawn from the same reservoir as the low service, the additional pressure being gained by a separate pipe running direct from the reservoir to the Highlands.

To secure better service on the Highlands a stand-pipe fifty feet in diameter and thirty-five feet in height, with a capacity of

500,000 gallons has been constructed by E. Hodge & Co., on the summit of a hill near by the present reservoir.

The additional pressure given will be thirty-three pounds.

The foundation was built by J. E. Manning and based on solid ledge and consists of a brick wall laid in Portland cement around the entire area; the inside area between the walls is filled with concrete composed of one part Portland cement, two parts sand and five parts broken stone, varying in thickness from two and one-half feet at the greatest depth to eight inches at the least.

The pumping plant designed and constructed by Arthur J. L. Loretz, of Brooklyn, is located in the low service pumping station, and consists of two pumps attached to the Loretz engine, so arranged and constructed as to draw their supply either from the pump well direct, or force main to a capacity of 1,500,000 gallons per day. Also to be connected on their delivery so that they can deliver either to the high or low service reservoir or both at the same time. There is also included an auxiliary pumping engine for a duplicate plant, so arranged as to either pump direct from the pump well at the rate of 1,000,000 gallons per day into the high service, or 1,500,000 gallons into the low. In this manner the capacity of the pumpage will be increased in the low service, and the entire pumping system arranged to reduce the extra fuel consumption and maintenance to a minimum.

Pumping Station.

Both pumping engines are in first-class condition. The feed water tank and piping around the feed pumps of the Loretz engine have been changed to make room for the new high service pumps. The side walls of the old boilers have been repaired and the setting partly relaid. The cement flooring in the coal shed has been repaired by placing iron plates in the cement.

A new flight of iron steps has been built in the fire room and all of the doors from the fire room have been covered with tin.

New timbers and plank flooring have been laid over the Leavitt suction wall to replace the old ones. One hundred feet of 2-inch fire hose has been procured to replace the old in the engine room.

Street Mains.

During the year 6,325 feet of cement-lined pipe was taken up and replaced with cast-iron mains in the following streets: Bedford, Blossom, Bond, Johnson, Pleasant, Silsbee, and Mt. Pleasant place. A change of grade made it necessary to lower the water pipes in Linwood and Grant streets and Beacon Hill avenue, a length of 930 feet; 4,795 feet of cast-iron pipes from 4-inch to 8-inch diameter has been laid in nineteen streets, as petitioned for by the abutters.

The high service required replacing 1,067 feet of 16-inch cement-lined pipe with cast-iron, and 1,509 feet of 12-inch new; 167 bursts came in the cement-lined pipe during the year; 7 gates have been set in connection with the new mains; 4 new gates were used in the high service; 7 gates replaced old gates; 8 new hydrants replaced old ones; 21 leaks in hydrants and 10 leaks in gates were repaired; 27 new main gate boxes were set; 65 main gate boxes raised where streets were graded; 317 feet of ledge was excavated in trenching for mains in new work; 455 feet where pipe was lowered and 1,247 feet in the high service trenches; 279 services have been put in, aggregating 13,357 feet in length; 20 services have been extended; a total length of 848 feet; 83 have been discontinued; 26 services renewed; 275 were changed from the old pipe to the new; 1,287 corporations were drilled out; 161 lead pieces put in place of old ones; 321 new iron stop boxes to replace old wooden ones; 248 leaks in service pipes were repaired; 104 services were cleaned out and reset; 17 service boxes changed for curbstones; 437 service boxes were raised; 18 services were lowered; 293 services were thawed out; 72 new stop and wastes were put in to replace old ones; 15 private hydrants were repaired; 320 new meters were set; 182 meters were taken out, tested and repaired; 12 new meter boxes replaced old ones; 5 stand-pipes repaired. The following tables show the work performed by the department during the year.

Respectfully submitted,

JOHN C. HASKELL,

Superintendent.

ANALYSIS OF WATER FROM TAP IN CITY BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

Collection.	Examination.	APPEARANCE.		ODOR.	RESIDUE ON EVAPORATION.					AMMONIA.		Chlorine.	NITRO-GEN AS		Oxygen consumed.	Hardness.	Iron.			
		Turbidity.	Sediment.		Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.		Total.	In solution.				In suspension.		
																			Albuminoid.	
Jan. 8 Jan.	9 Slight.			Slight.	0.93	Decidedly vegetable and mouldy.	Decidedly vegetable mouldy to musty.	6.55	2.75	3.80	.0040	.0212	.0198	.0014	.78	.0130	.0001	.8775	2.3	.0175
Feb. 12 Feb.	13 Very slight.			Slight.	1.05	Faintly vegetable.	Faintly vegetable.	7.60	2.70	4.90	.0060	.0228	.0226	.0002	.87	.0200	.0002	.9360	2.9	.0200
Mar. 12 Mar.	13 Very slight.			Slight.	0.73	Faintly vegetable.	Faintly vegetable.	5.65	1.95	3.70	.0040	.0166	.0152	.0014	.67	.0186	.0002	.7916	1.7	.0160
Apr. 9 Apr.	10 Very slight.			Slight.	0.62	Distinctly vegetable.	Faintly vegetable.	4.50	2.05	2.45	.0008	.0156	.0142	.0014	.54	.0166	.0000	.5898	1.4	.0100
May 13 May	14 Very slight.			Slight.	1.90	Distinctly vegetable and sweetish.	Distinctly vegetable	6.15	2.60	3.55	.0008	.0236	.0318	.0018	.74	.0070	.0001	1.7380	2.5	.0200
June 11 June	12 Slight.			Considerable brown.	0.70	Distinct veg. somewhat unpleasant.	Distinctly vegetable	4.95	2.10	1.95	.0000	.0236	.0196	.0040	.48	.0120	.0001	.640	1.1	..
July 16 July	17 Slight.			Considerable.	0.95	Faintly vegetable.	Faint or none.	4.90	2.25	2.65	.0014	.0252	.0230	.0022	.62	.0120	.0001	1.5600	1.7	..
Aug. 12 Aug.	14 Distinct.			Slight rusty.	0.40	Faintly vegetable and sweetish.	Faintly vegetable.	4.70	2.00	2.70	.0004	.0268	.0186	.0088	.69	.0030	.0001	.4914	1.6	..
Sept. 9 Sept.	11 Distinct.			Slight.	0.60	Distinctly vegetable.	Distinctly vegetable	4.35	1.95	2.40	.0004	.0268	.0162	.0046	.66	.0020	.0001	.5538	1.9	..
Oct. 9 Oct.	10 Very slight.			Slight brown.	0.40	Faintly vegetable and unpleasant.	Faintly vegetable.	4.15	1.80	2.35	.0022	.0222	.0190	.0032	.67	.0050	.0000	.4524	1.6	..
Nov. 12 Nov.	13 Slight.			Slight.	0.55	Very faint or none.	Distinctly vegetable.	4.60	1.75	2.85	.0000	.0196	.0168	.0028	.60	.0120	.0001	.4691	1.1	..
Dec. 9 Dec.	11 Very slight.			Slight.	0.88	Faintly vegetable.	Distinctly vegetable.	4.20	1.75	2.45	.0001	.0216	.0176	.0040	.44	.0030	.0000	.7527	0.9	..

ANALYSIS OF WATER IN HOWLETT'S POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	APPEARANCE.	Color.	ODOR.		RESIDUE ON EVAPORATION.												
					AMMONIA.					NITRO- GEN AS							
					Turbidity.	Sediment.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Chlorine.	Nitrites.	Nitrate.	Oxygen consumed.	Hardness.	Iron.
Jan. 8 Jan. 9	Slight.	1.40	Decidedly vegetable and musty.	Decidedly vegetable and musty.	9.50	4.10	5.40	.0106	.0344	.0334	.0010	.47	.0000	.0003	1.5310	3.9	.0050
Feb. 12 Feb. 13	Very slight.	1.25	Distinctly vegetable and sweetish.	Distinctly vegetable and sweetish.	9.70	3.20	6.50	.0142	.0066	.0066	.0012	.103	.0050	.0003	1.4800	4.2	.0000
Mar. 12 Mar. 13	Very slight.	0.85	Faintly vegetable.	Distinctly vegetable	6.85	2.45	3.50	.0064	.0030	.0006	.0004	.60	.0030	.0005	.7630	2.1	.0150
Apr. 9 Apr. 10	Very slight.	0.40	Distinctly vegetable and sweetish.	Distinctly vegetable and sweetish.	5.80	2.55	3.25	.0045	.0050	.0038	.0012	.54	.0120	.0000	.8162	1.9	.0135
May 13 May 14	Considerable	2.55	Decidedly vegetable and unpleasant.	Decidedly vegetable what unpleasant.	8.75	3.95	4.80	.0148	.0510	.0452	.0068	.74	.0100	.0007	2.2515	3.0	.1000
June 11 June 12	Considerable brown.	1.15	Decidedly vegetable and unpleasant.	Decidedly vegetable and unpleasant.	7.25	3.85	3.40	.0034	.0342	.0090	.0052	.88	.0070	.0006	.9890	2.5	.0000
July 16 July 17	Slight.	1.35	Decidedly vegetable and sweetish.	Decidedly vegetable and unpleasant.	8.85	4.00	4.85	.0018	.0466	.0466	.0050	1.05	.0050	.0001	1.0140	3.4	.0000
Aug. 12 Aug. 14	Slight rusty.	1.00	Decidedly veg. and mouldy straw.	Decidedly veg. ac- tringed and mouldy.	9.60	4.90	4.70	.0036	.0030	.0543	.0072	.40	.0070	.0001	2.5740	3.1	.0000
Sept. 9 Sept. 11	Distinct.	0.95	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	9.65	4.40	5.25	.0106	.0402	.0380	.0022	1.35	.0020	.0001	1.0453	3.5	.0000
Oct. 9 Oct. 10	Very slight.	0.75	Decidedly vegetable and grassy.	Decidedly vegetable and grassy.	9.40	3.45	5.95	.0000	.0340	.0086	.0051	1.40	.0000	.0000	.7944	4.4	.0000
Nov. 12 Nov. 13	Very slight.	1.30	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	8.00	3.40	4.60	.0043	.0386	.0362	.0026	.92	.0300	.0005	1.3542	2.7	.0000
Dec. 9 Dec. 11	Very slight.	1.25	Faintly vegetable and mouldy.	Decidedly vegetable and mouldy.	7.25	3.25	4.00	.0016	.0150	.0128	.0002	.77	.0100	.0002	1.2240	2.9	.0000

ANALYSIS OF WATER IN WALDEN POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	APPEARANCE.		ODOR.	RESIDUE ON EVAPORATION.	AMMONIA.			NITRO- GEN AS		Hardness.	Iron.								
	Turbidity.	Sediment.			Color.	Free.	Total.	In solution.	In suspension.			Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.				
May 13 June 11 July 16	Very slight. Slight. Slight.	Considerable. Cons. brown. Considerable.	Cold. Hot.	Total. Loss on ignition. Fixed.	3.90 3.65 4.40	1.70 2.10 2.25	2.20 1.55 2.15	.0007 .0002 .0328	.0242 .0304 .0536	.0022 .0080 .0216		.46 .56 .50	.0030 .0001 .0070	.0000 .0001 .0003	7.386 631.8 8580	1.1 0.6 0.5	.0120		
											Distinctly vegetable and unpleasant.							Distinctly vegetable and unpleasant.	Distinctly vegetable and somewhat unpleasant.
											Distinctly vegetable and unpleasant.							Distinctly vegetable and unpleasant.	Distinctly vegetable and somewhat unpleasant.

ANALYSIS OF WATER IN SAUGUS RIVER BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	RESIDUE ON EVAPORATION.				AMMONIA.		NITROGENS.			
							Total.	Loss on ignition.	Fixed.	Free.	Albuminoid.		Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.
											In solution.	In suspension.				
Jan. 8 Jan. 9 Slight.				1.55	Decidedly disagreeable and musty.	Decid. disagreeable and musty.	9.55 3.70 5.85 .0069				.0376	.0366	.0010	.0000	.0000	1.6740 4.0 .0360
Feb. 12 Feb. 13 Very slight.				1.40	Faintly vegetable.	Dist. veg., somewhat unpleasant.	9.00 3.50 5.50 .0060				.0324	.0322	.0002	.0000	.0000	1.6000 4.7 .0360
Mar. 12 Mar. 13 Very slight.				1.00	Distinctly vegetable and sweetish.	Distinctly vegetable and sweetish.	3.00 3.50 3.40 .0014				.0030	.0000	.0000	.0050	.0001	.8501 3.1 .0180
April 9 April 10 Very slight.				0.85	Faintly vegetable.	Family vegetable and sweetish.	4.35 1.00 2.45 .0030				.0022	.0180	.0004	.0000	.0000	.7060 1.3 .0090
May 13 May 14 Very slight.				2.40	Distinctly vegetable and sweetish.	Decidedly vegetable and sweetish.	8.00 4.40 4.30 .0026				.0426	.0444	.0052	.0050	.0001	2.5380 3.0 .0330
June 11 June 12 Very slight.				1.30	Distinctly vegetable.	Decidedly vegetable and sweetish.	5.65 3.35 3.30 .0068				.0330	.0306	.0014	.0000	.0000	1.1720 2.9 .0000
July 16 July 17 Slight.				1.80	Faintly vegetable.	Distinctly vegetable and sweetish.	7.95 4.10 3.85 .0010				.0446	.0436	.0010	.0050	.0001	1.7160 3.2 .0000
Aug. 13 Aug. 14 Very slight.				1.00	Faintly vegetable.	Distinctly vegetable and musty.	9.35 4.20 4.65 .0028				.0508	.0480	.0028	.0030	.0002	2.1480 3.6 .0000
Sept. 9 Sept. 11 Distinct.				1.00	Decidedly vegetable and mouldy.	Distinctly vegetable and mouldy.	8.55 3.45 3.10 .0026				.0310	.0294	.0016	.0000	.0001	1.0920 4.0 .0000
Oct. 9 Oct. 10 Very slight.				0.80	Distinctly vegetable and grassy.	Faintly vegetable and grassy.	3.55 3.00 3.55 .0068				.0306	.0300	.0030	.0000	.0000	.9140 4.6 .0000
Nov. 12 Nov. 13 Very slight.				1.40	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	6.00 3.20 3.40 .0012				.0300	.0288	.0022	.0050	.0000	1.4517 2.5 .0000
Dec. 9 Dec. 11 Very slight.				0.35	Faintly vegetable.	Distinctly vegetable and mouldy.	7.40 3.35 4.05 .0004				.0306	.0288	.0022	.0000	.0000	1.3020 2.9 .0000

ANALYSIS OF WATER IN BREED'S POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITRO- GEN AS		Oxygen consumed.	Hardness.					
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.			In suspension.	Chlorine.	Nitrates.	Nitrites.	
Jan. 8	9	Very slight.	Slight.	0.62	Faintly vegetable.	Faintly vegetable.	3.90	1.25	2.65	.0030	.0176	.0168	.0014	.65	.0040	.0000	.4797	0.9	.0215
Feb. 12	13	Very slight.	Very slight.	0.50	Very faintly vegetable.	Dist. veg., somewhat unpleasant.	4.00	1.10	2.90	.0016	.0152	.0122	.0030	.78	.0050	.0000	.5000	1.3	.0070
Mar. 12	13	Slight.	Considerable.	0.25	Faintly vegetable.	Distinctly vegetable and unpleasant.	3.15	1.25	1.90	.0008	.0166	.0094	.0072	.54	.0050	.0001	.3580	0.6	.0055
Apr. 9	10	Slight.	Considerable.	0.53	Faintly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	3.70	1.55	2.15	.0010	.0124	.0102	.0022	.56	.0050	.0000	.5197	0.9	.0090
May 13	14	Slight.	Slight.	0.52	Distinctly vegetable.	Decidedly vegetable (green corn).	3.80	1.30	2.50	.0002	.0216	.0172	.0044	.52	.0020	.0000	.5372	1.1	.0060
June 11	12	Slight.	Cons. brown.	0.40	Distinctly vegetable.	Faintly vegetable.	3.80	2.10	1.70	.0010	.0174	.0158	.0016	.52	.0050	.0001	.4820	0.8	..
July 16	17	Slight.	Considerable.	0.50	Faintly and grassy.	Distinctly vegetable.	3.25	1.55	1.70	.0000	.0214	.0188	.0026	.58	.0070	.0001	.4914	0.7	..
Aug. 14	14	Distinct.	Consid. light colored.	0.33	Faintly vegetable.	Distinctly vegetable and sweetish.	3.70	1.40	2.30	.0012	.0212	.0188	.0024	.59	.0030	.0001	.5148	0.9	..
Sept. 9	11	Distinct.	Slight.	0.33	Faintly vegetable.	Distinctly vegetable.	4.10	1.50	2.60	.0000	.0220	.0198	.0022	.61	.0000	.0001	.4914	0.9	..
Oct. 9	10	Very slight.	Slight.	0.37	Distinctly vegetable.	Distinctly vegetable.	3.55	1.30	2.25	.0004	.0256	.0226	.0030	.66	.0000	.0000	.4900	0.9	..
Nov. 12	13	Very slight.	Very slight.	0.57	Faintly vegetable.	Distinctly vegetable.	4.00	1.85	2.15	.0044	.0202	.0270	.0022	.52	.0050	.0000	.5788	1.3	..
Dec. 9	11	Very slight.	Slight.	0.90	None.	Distinct.	4.00	1.65	2.35	.0054	.0186	.0172	.0014	.46	.0020	.0001	.6565	0.8	..

ANALYSIS OF WATER IN BIRCH POND BY STATE BOARD OF HEALTH

PANTS IN 100,000.

Collection.	Examination.	Turbidity.	Sediment.	Cold.	Hot.	Color.	APPEARANCE.	ODOR.	RESIDUE ON EVAPORATION.										Oxygen consumed.	Hardness.	Iron.	
									Total.	Loss on ignition.	Fixed.	Free.	Total.	AMMONIA.		Chlorine.	Nitrates.	Nitrites.				NITRO-GEN AS
														In solution.	In suspension.								Albuminoid.
Jan. 5 Jan.	Decided	Slight.			Decidedly vegetable and mildly.	0.00			7.40	1.30	3.70	.0018	.0426	.0264	.0162	.86	.0100	.0000	.7661	1.6	.0167	
Feb. 12 Feb.	Very slight.	Slight.			Distinctly vegetable and unpleasant.	0.66			5.65	2.05	3.60	.0080	.0376	.0248	.0148	.78	.0100	.0000	.7216	1.8	.0080	
Apr. 9 Apr.	Very slight.	Slight.			Distinctly vegetable and unpleasant.	0.55			5.15	.75	3.40	.0038	.0248	.0158	.0070	.71	.0080	.0000	.6683	1.7	.0150	
May 13 May	Slight.				Decidedly vegetable and unpleasant.	0.47			4.75	.60	3.15	.0004	.0266	.0170	.0050	.66	.0030	.0000	.6136	1.7	.0080	
June 11 June	Slight.				Decidedly vegetable and green corn.	0.30			4.35	.75	3.50	.0006	.0260	.0170	.0048	.66	.0000	.0000	.4742	1.1	..	
July 16 July	Slight.				Decidedly vegetable and grassy.	0.20			4.65	2.30	2.35	.0004	.0264	.0180	.0078	.66	.0012	.0000	.4968	1.3	..	
Aug. 12 Aug.	Distinct.				Distinctly vegetable.	0.35			4.40	.95	2.45	.0000	.0260	.0200	.0030	.68	.0040	.0000	.5304	1.3	..	
Sept. 9 Sept.	Distinct.				Distinctly vegetable.	0.48			4.60	1.95	2.65	.0006	.0256	.0200	.0030	.71	.0000	.0000	.5538	1.4	..	
Oct. 9 Oct.	Very slight.	Slight.			Faintly vegetable and unpleasant.	0.26			4.15	.95	2.20	.0000	.0264	.0200	.0050	.75	.0030	.0000	.5538	0.9	..	
Nov. 12 Nov.	Distinct.				Faintly vegetable.	0.20			5.50	2.35	3.45	.0006	.0250	.0200	.0060	.69	.0120	.0000	.5131	1.4	..	
Dec. 9 Dec.	Very slight.	Slight.			Distinct.	0.20			4.50	2.45	3.35	.0030	.0178	.0160	.0016	.52	.0100	.0000	.3673	1.3	..	

ANALYSIS OF WATER IN GLEN LEWIS POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.		NITROGEN AS		Oxygen consumed.	Hardness.	Iron.				
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.				In suspension.	Chlorine.	Nitrates.	Nitrites.
Jan. 8	Jan. 9	Decided.	Slight.	0.73	Decidedly disagreeable.	Distinctly vegetable	4.55	2.00	2.55	.0034	.0254	.0242	.0112	.58	..	..	8.46	0.8	.0080
Feb. 12	Feb. 13	Very slight.	Very slight.	0.55	Distinctly vegetable	Distinctly vegetable and unpleasant.	3.90	1.50	4.40	.0102	.0240	.0228	.0012	.59	.0030	..	.5660	0.8	.0140
Mar. 12	Mar. 13	Slight.	Considerable.	0.25	Faintly vegetable.	Distinctly vegetable and unpleasant.	3.15	1.35	1.80	.0144	.0146	.0136	.0010	.43	.0050	..	.3349	1.9	.0115
April 9	April 10	Slight.	Considerable.	0.50	Distinctly vegetable and disagreeable.	Distinctly vegetable and disagreeable.	3.55	1.30	2.25	.0036	.0314	.0206	.0108	.45	.0040	..	.4600	0.3	.0390
May 13	May 14	Slight.	Considerable.	0.45	Distinctly vegetable and unpleasant.	Decidedly vegetable	3.55	1.55	2.00	..	.0306	.0226	.0080	.48	.0030	..	.5253	0.8	.0235
June 11	June 12	Slight.	Cons. brown.	0.40	Decidedly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	3.20	1.45	1.75	.0012	.0230	.0184	.0046	.50	.0050	.0001	.3978	0.3	..
July 16	July 17	Distinct.	Considerable.	0.53	Decidedly vegetable and unpleasant.	Distinctly vegetable and unpleasant.	4.30	1.65	2.65	.0004	.0084	.0026	.0058	.50	.0050	.0001	.4914	0.5	..
Aug. 12	Aug. 14	Decid. green.	Cons. green and brown.	0.42	Decid. veg., grassy and mouldy.	Decid. veg., grassy on wet corn.	3.25	1.35	1.90	.0052	.0796	.0318	.0178	.48	.0030	.0002	.0360	0.5	..
Sept. 9	Sept. 11	Decid. green.	Heavy green scum.	0.25	Distinctly vegetable and sweetish.	Decidedly sweetish and pleasant.	3.60	1.65	1.95	.0028	.0706	.0272	.0434	.55	..	.0001	.5694	0.9	..
Oct. 9	Oct. 10	Distinct.	Cons. green.	0.25	Distinctly vegetable and grassy.	Distinctly vegetable and grassy.	4.15	2.20	1.95	.0016	.0550	.0366	.0184	.56	.0030	..	.5366	0.8	..
Nov. 12	Nov. 13	Slight green.	Slight.	0.30	Distinctly mouldy and grassy.	Decidedly vegetable and grassy.	3.90	2.00	1.90	.0098	.0372	.0336	.0036	.48	.0080	.0001	.5600	0.6	..
Dec. 9	Dec. 11	Dist. green.	Very slight.	0.37	Faintly vegetable.	Distinctly sweet and grassy.	4.15	1.85	2.30	.0106	.0276	.0218	.0058	.42	.0030	.0002	.5772	0.5	..

TABLE I.

SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING
DECEMBER 31, 1895.

MONTH.	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
	Gallons.	Gallons.	Gallons.	Gallons.	Galls.	Galls.
January	123,850,675	4,156,473	339,338	. . . . .	68.17	64.40
February	128,577,700	4,599,775	436,302	. . . . .	68.69	71.16
March	130,778,926	4,218,675	. . . . .	374,100	63.10	65.37
April	112,043,039	3,733,767	. . . . .	484,908	55.84	57.85
May	120,225,324	3,978,236	144,469	. . . . .	58.00	60.09
June	131,748,798	4,390,959	512,723	. . . . .	65.67	68.04
July	142,113,894	4,534,319	193,360	. . . . .	68.96	71.03
August	144,947,107	4,675,713	91,394	. . . . .	69.93	72.45
September	146,569,677	4,835,422	209,709	. . . . .	73.07	75.70
October	139,174,076	4,450,486	. . . . .	305,936	67.15	69.56
November	131,207,842	4,376,595	. . . . .	112,891	65.46	67.51
December	135,161,855	4,360,060	. . . . .	16,535	65.21	67.56
Totals and averages	1,501,451,913	4,360,142	. . . . .	. . . . .	65.21	67.56

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1895.

MONTH.	BREED'S.	BIRCH.	CANAL.	Total.
	Gallons.	Gallons.	Gallons.	Gallons.
January	17,021,876	. . . . .	112,767,124	129,789,000
February	19,949,398	. . . . .	108,648,302	128,597,700
March	11,430,210	. . . . .	117,669,090	129,099,300
April . . . . .	. . . . .	. . . . .	114,765,560	114,765,560
May . . . . .	. . . . .	. . . . .	117,041,470	117,041,470
June	10,194,691	. . . . .	121,410,869	131,605,560
July	9,530,400	68,648,000	38,121,600	146,300,000
August	15,387,100	129,115,500	. . . . .	144,502,600
September	20,862,380	123,870,120	. . . . .	144,732,500
October	82,534,100	53,270,650	. . . . .	140,813,750
November	34,256,493	. . . . .	97,549,357	131,805,850
December	26,763,495	. . . . .	109,043,405	136,706,900
Total	247,930,143	409,913,270	937,916,777	1,595,760,190

TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1895.

Day of Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1						0.15						
2												
3		0.15	0.50	0.37				0.26			0.57	0.12
4		0.01		0.03								
5		0.12	0.10		0.20	0.10	0.10					0.04
6					0.02							0.50
7	0.35		0.10			0.15	0.09					
8	0.04		0.68									
9	0.23	0.53	0.12	0.46	0.01			1.51		0.20		
10			0.02	0.47			0.80		0.30		0.15	
11	0.97											
12								0.22	0.48			
13					1.05					1.95		
14	0.03		0.88	0.40	0.53	0.01	0.68			4.72		0.04
15				1.07	0.08						1.66	
16			0.10	0.08	0.08	0.03				0.07	0.30	
17					0.04						0.70	
18	0.41				0.12			1.60	0.07			
19											0.76	
20											0.30	
21	0.30		0.02		0.01	0.02	0.04					0.67
22				0.20			0.03					0.02
23												
24			0.10								0.10	
25	0.40				0.10	0.33			0.05		1.10	
26	0.10			0.10					0.27			0.30
27			0.10	0.01	0.23	0.10	0.07					
28	0.05		0.07		0.02	1.33		0.01				
29	0.04		0.06	0.16					0.10			0.70
30						0.26	1.23					
31					0.10			0.65		3.18		
Total . .	3.72	1.11	3.05	3.35	3.21	3.23	3.15	4.55	1.27	10.12	5.64	2.39

Total for the year 44.79

*Snow.

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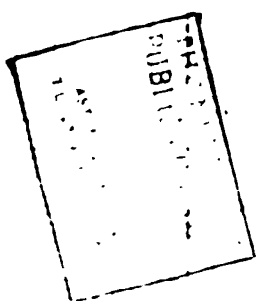


TABLE IV.

SHOWING THE RAINFALL AT CITY HALL FOR 1895.

Day of Month.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1.			.04	*.33		.02		.53			*1.60	.07
2.		*.14	.24	.03								
3.					.80	.09	.09					*.05
4.		*.07	.07		.01	.12	.02					*.15
5.	.35		*.09									
6.	.01	.55	.68					2.02				
7.	.19		.07	.53	.01							
8.				.38			1.33		.32	.20	.10	
9.	.83							.19				
10.								.01	.43	2.00		
11.	.04				.94					4.22		
12.				.38			.69	.01				
13.			.90	.99	.92						1.57	
14.			*.09	.06	.10	.11	.05			.07	.15	
15.											.66	
16.	.40											
17.					.21			1.63	.08		.82	
18.	.04										.30	
19.					.01	.01	.05				.01	.57
20.											.10	
21.	.24			.20								
22.						.28					.13	
23.			.07	.01	.10				.04		.90	.31
24.	*.41			.11	.02				.10			
25.	.53			.02	.25	.39	.05					
26.			*.28	.01	.02	1.10						
27.	*.05		.02									
28.			*.05	.12			.85	.01	.10			
29.	.04			.01		.19						.64
30.					.15			.80		3.23		
31.												
Totals . .	3.13	.76	2.60	3.16	3.54	2.31	3.18	5.18	1.07	9.72	5.34	1.69

Total rainfall, 41.68.

*Snow.

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1895.

STREET.	LOCATION.
Ashcroft . . .	On line north side Magnolia avenue, 17 feet east of west line Ashcroft.
Bond	On line east side Church street, 11 feet north of south side Bond.
Clark	On line south side Eastern avenue, 17 feet east of west line Clark.
Commercial place	On line west side Commercial street, 17 feet east of west line Commercial place.
Crosby	On line west side Blossom street, 11 feet south of north line Crosby.
Greystone park .	On line south side Ocean street, 13 feet west of east side Greystone park.
Mt. Pleasant place	On line north side Essex street, 5 feet west of east side Mt. Pleasant place.

TABLE VII.

SHOWING THE LOCATION OF HYDRANTS SET IN 1895.

STREET.	LOCATION.
Greystone park .	434 feet from Ocean street.
Ireson street . .	Opposite east end School-house.
Commercial place	Corner of Curve.

TABLE VIII.

LEAKS IN PIPES AND HYDRANTS.

MONTH.	SIZE OF MAINS.							
	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	Hyd.
January	1	3	2
February	1	...	...	...	4	1	1
March	3	5	2
April	1	1	4	8	1
May	6	12	2
June	2	1	...	5	8	1
July	2	2	2	1	2	13	3
August	1	...	...	...	...	2	12	3
September	1	1	6	3	1
October	2	1	12	8	...
November	1	5	5	4
December	2	7	1
	1	3	4	7	5	52	89	21

TABLE IX.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE IN 1895.

KIND.	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	3	4	Total
Thomson Bee	86	258	38	...	5	...	...	387
Trident	104	148	20	...	1	1	...	274
Thomson	54	103	51	...	10	2	1	222
Ball & Fitts	39	47	19	...	1	...	...	106
Union	15	12	...	7	9	15	58
Worthington	5	14	18	3	1	12	1	54
Hersey	4	22	...	...	2	...	...	28
Columbia	13	7	...	...	...	...	...	20
Crown	1	1	9	5	...	...	2	...	18
Weir	1	...	3	5	...	4	1	...	14
Neptune	9	3	...	...	...	1	...	13
Nash	2	3	1	...	...	...	...	6
Empire	3	...	...	3
Niagara	1	...	...	...	...	1
Frost	1	...	...	...	...	...	1
Gem	1	...	...	1
Motors	2
Totals	2	317	633	170	3	31	32	2	1,205

Total gallons metered, 215,591,850.

TABLE X.

SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICES LAID IN 1895.

MONTH.	SIZE AND LENGTH OF FISH.																Total.			
	6 in.		4 in.		3 1/2 in.		3 in.		1 1/2 in.		1 in.		3/4 in.							
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.						
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.						
February																				
April																				
May	1	17.1																		
June																				
July																				
August																				
September																				
October																				
November	2	53.6																		
December																				
Totals	3	70.7	1	24.3	1	23.3	6	51.4	7	63.4	13	98.0	10	136	6	596.5	118	4,895.2	279	13,196.11

TABLE XI.

SHOWING THE AMOUNT AND SIZE OF CAST-IRON PIPE LAID IN 1895.

WHERE LAID.	16 in.	12 in.	8 in.	6 in.	4 in.
High Service	*1,017	1,509			
Apple street					123
Ashcroft street				284	
Beacon Hill avenue				*96	
Bachelor street				283	
Bedford street					220
Blossom street					*502
Bond street				*1,086	*32
Clark street					*371
Clovelly street				300	242
Commercial place				603	
Columbus avenue					75
Crosby street					32
Eastern avenue			192		
Grant street				*437	
Greystone park					434
Gertrude street					90
Florence street					32
Harrison avenue				243	
Johnson street				*1,773	*74
Linwood street				*397	
Maple street					190
Mt. Pleasant place					*210
Newton street					72
Pleasant street				*839	
Quebec street				136	
Rock avenue				94	
Silsbee street				*377	*36
Superior street				*115	214
Waltt avenue				53	765
Wilson street				104	
Totals	1,017	1,509	192	8,125	3,723

*Relaid.

	MILES.	FEET.
Total pipe laid in 1895		14,576
Cement pipe taken up and replaced with cast-iron pipe . .		8,272
Total extension		6,304
Previously laid	107	768
Private pipe in Swampscott		1,788
Pipe in Saugus	16	450
Total supplied by the works	124	4,030

TABLE XIII
RECORD OF THE LORETZ ENGINE FOR THE YEAR ENDING DECEMBER 31, 1895.

DATE.	Month.	Days	Number of pumping days.	Total pumping time per month.	H. M.	H. M.	Average pumping time per day.	Number of revolutions per month.	Rev.	Average revolutions per minute.	COAL CONSUMED.						Ashes.		Gallons pumped per month.	Average number of gals. pumped per lb. of coal.	Average number of gal. raised 100 feet high per pound of coal.	Feet.	Average head against the pump.	Lbs.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, no deduction for ashes.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, the ashes deducted.	OIL.	Waste.
											Raising steam.	Pumping.	Banking.	Total.	Lbs.	Lbs.	Lbs.	P.ct.											Lbs.	Gals.
January	February	27	489.40	18.08	621,000	21.13	6,133	166,100	2,700	174,933	18,200	10.20	129,780,000	743.4	1,182.67	159.10	95,437.879	109,868,588	12	21								
March	April	25	453.25	18.08	615,300	22.61	6,400	166,200	3,600	170,200	15,250	8.53	128,597,700	730.	1,169.11	106.15	97,481,070	106,717,388	16	20								
May	June	27	488.50	18.06	617,700	21.06	6,100	170,000	3,800	180,200	14,140	7.71	120,099,300	716.4	1,155.10	101.23	96,334,313	104,537,174	10	30								
July	August	27	488.50	18.06	617,700	21.06	6,100	170,000	3,800	180,200	14,140	7.71	120,099,300	716.4	1,155.10	101.23	96,334,313	104,537,174	10	30								
September	October	27	488.50	18.06	617,700	21.06	6,100	170,000	3,800	180,200	14,140	7.71	120,099,300	716.4	1,155.10	101.23	96,334,313	104,537,174	10	30								
November	December	25	443.08	17.48	630,650	23.81	4,200	171,400	2,700	178,300	16,600	10.20	131,863,650	739.3	1,174.38	158.85	97,034,703	110,600,079	14	25								
Totals and Averages			4,441.15	18.31	5,985,000	23.45	48,065	1,650,700	35,700	1,724,465	169,500	9.83	1,251,053,100	725.5	1,164.21	160.47	97,001,511	107,075,036	144	223								

TABLE XII.

RECORD OF THE LEAVITT ENGINE FOR THE YEAR ENDING DECEMBER 31, 1893.

DATE.	Number of pumping days.	Total pumping time per month.	Average pumping time per day.	Number of revolutions per month.	Average revolutions per minute.	Raising steam.	COAL CONSUMED.				GALLONS PUMPED PER MONTH.						Average head against the pump.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, no deduction for ashes.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, ashes deducted.	Oil.	Waste.
							Pumping.	Banking.	Total.	Asbes.	Gals.	Gals.	Gals.	Feet.	Lbs.	Lbs.					
Month.	Days	H. M.	H. M.	Rev.	Rev.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	P. ct.	Gals.	Gals.	Gals.	Feet.	Lbs.	Lbs.	Lbs.	Gals.	Lbs.	
January.																					
February.																					
March.																					
April.	26	57 32		615,000	17.86	3,000	144,000	800	144,100	13,160	8.63	114,765	600	115,365	600	105,365	111	105,365	111	55	
May.	26	57 30 23		627,400	18.11	3,000	145,700	1,000	144,000	10,720	7.90	117,040	700	117,740	700	106,740	105	106,740	105	46	
June.	26	57 30 23		605,000	18.47	1,400	151,000	600	144,500	10,000	7.57	114,960	600	115,560	600	105,560	111	105,560	111	46	
July.																					
August.																					
September.																					
October.																					
November.																					
December.																					
Totals and Averages.	70	1 App.	31.43	1,847,800	18.33	7,400	486,500	5,500	486,500	34,500	7.91	344,700	400	345,700	400	308,888	160.68	308,888	160.68	335	

TABLE XIII
RECORD OF THE LORETZ ENGINE FOR THE YEAR ENDING DECEMBER 31, 1895.

DATE.	Month.	Days	H. M.	Total pumping time per month.	H. M.	Average pumping time per day.	Number of revolutions per month.	Rev.	Average revolutions per minute.	COAL CONSUMED.				Gallons pumped per month.	Average number of gal. pumped per lb. of coal.	Average number of gal. raised 100 feet high per pound of coal.	Average head against the pump.	Feet.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, no deduction for ashes.	Average duty in lbs. of water raised 1 foot high per 100 lbs. of coal, the ashes deducted.	Oil.	Waste.
										Raising steam.	Pumping.	Banking.	Total.	Ashes.								
										Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Pct.	Gals.	Gals.	Gals.	Lbs.	Lbs.	Gals.	Lbs.
January	27	456.40	18.08	631,000	21.13	6,133	29,500	20.15	1,166	166,100	2,700	174,933	18,200	10.20	129,759,000	743.4	1,184.67	159.10	98,437,879	109,868,588	12	21
February	25	453.25	18.08	615,300	22.61	6,400	700,000	22.16	4,800	166,400	3,900	170,200	15,250	8.53	138,597,700	730.1	1,169.11	160.15	97,481,070	106,717,388	16	20
March	27	488.50	18.06	617,700	21.06	6,400	39,500	20.15	1,166	170,000	3,900	188,200	14,140	7.71	190,099,300	716.4	1,155.10	161.23	96,334,313	104,537,174	10	20
April	27	488.50	18.06	617,700	21.06	6,400	39,500	20.15	1,166	170,000	3,900	188,200	14,140	7.71	190,099,300	716.4	1,155.10	161.23	96,334,313	104,537,174	10	20
May	27	488.50	18.06	617,700	21.06	6,400	39,500	20.15	1,166	170,000	3,900	188,200	14,140	7.71	190,099,300	716.4	1,155.10	161.23	96,334,313	104,537,174	10	20
June	4	74.18	18.30	59,500	20.15	1,166	29,500	20.15	1,166	17,000	300	25,466	2,000	7.81	18,705,500	739.3	1,185.54	160.36	98,220,296	106,608,627	4	15
July	26	536.20	20.14	700,000	22.16	4,800	700,000	22.16	4,800	174,400	2,700	204,600	18,305	8.91	146,300,000	715.1	1,151.69	161.27	96,054,873	105,527,034	15	20
August	27	497.25	18.27	691,400	23.16	5,166	691,400	23.16	5,166	192,400	2,700	200,266	22,300	11.18	144,502,600	722.1	1,168.30	161.79	97,301,255	106,616,515	21	20
September	25	495.25	19.49	692,500	23.29	4,800	692,500	23.29	4,800	196,200	2,100	202,500	20,815	10.28	144,732,500	714.7	1,149.23	160.79	95,844,263	106,836,553	17	15
October	27	493.18	18.15	673,750	22.78	4,400	673,750	22.78	4,400	191,100	2,700	198,200	20,270	10.23	140,813,750	710.4	1,139.52	160.40	95,041,183	105,868,388	15	20
November	25	445.05	17.48	630,650	23.51	4,800	630,650	23.51	4,800	171,400	2,700	178,300	19,600	10.99	131,805,850	739.2	1,174.28	155.85	97,634,703	110,000,679	14	25
December	26	459.25	17.40	654,100	23.73	5,200	654,100	23.73	5,200	175,600	2,700	183,800	18,450	10.20	136,706,900	743.8	1,197.39	160.98	98,858,009	111,000,315	20	25
Totals and Averages.		4,431.15	18.31	5,985,000	23.45	48,065	1,650,700	25.700	1,724,465	1,650,700	25,700	1,724,465	169,500	9.83	1,251,053,100	735.5	1,164.21	160.47	97,091,511	107,675,036	144	223

SUMMARY OF STATISTICS.

Report of 1895.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1895,

Lynn and Saugus,

66,861

Date of construction,

1870 to 1872

Owned by,

City of Lynn.

Source of supply,

Four artificial storage basins, formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co., of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek.

2. Cost of coal,

\$3.65, \$3.70 (2,000 lbs.) delivered.

	Leavitt.	Loretz.
3. Coal consumed for the year, in pounds,	436,500	1,723,799

4. Pounds of wood consumed in pounds coal,

3

222

PUBLIC WATER BOARD.

43

	Leavitt.	Loretz.
5. Total consumed for the year (3)+(4),		
	436,500	1,724,465
6. Total pumpage for the year, in gallons,		
	344,707,090	1,251,053,100
7. Average dynamic head against which pump works,		
	160.68	160 47
8. a. Number of gallons pumped per pound of coal (3)+(4),		
	789.70	725.50
b. Number of gallons raised 100 feet per pound of coal (3)+(4),		
	1,268.88	1,164.21
9. Duty, in foot pounds per 100 pounds of coal, no deductions,		
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed}}$		
	105,826,355	97,091,511

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$9,392.47.

10. Per million gallons raised against average dynamic head (7) into reservoir,	\$5.88
11. Per million gallons raised one foot high (dynamic),	3.65 cents

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ :
\$122,330.10.

12. Per million gallons raised against dynamic head (7) into reservoir,	\$76.65
13. Per million gallons raised one foot high (dynamic),	47.70 cents

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
<i>From Consumers:</i>			
A. Water rates, domestic,	\$135,906.71	AA. Management and repairs,	\$51,147.43
B. Water rates, manufacturing,	44,306.80	BB. Interest on bonds,	71,182.67
C. Net receipts, for water,	\$180,213.51	CC. Total maintenance,	\$122,330.10
D. Repairs and sundries,	5,359.37	DD. Balance carried to sinking fund,	63,247.78
E. Gross receipts from all sources,	\$185,572.88	EE. Total,	\$185,572.88

PUBLIC WATER BOARD.

45

CONSTRUCTION.

RECEIPTS.		EXPENDITURES.	
F. From balance of 1894,	\$27,586.69	FF. Extension of main lines,	\$6,193.19
G. Pipes, meters and labor,	4,298.04	GG. Extension of service pipes,	6,227.69
H. Loans,	165,000.00	HH. Highland service,	22,676.24
		II. Account ponds, Hawkes pond, Walden pond, and land bought,	92,085.13
			1,235.20
		JJ. Total construction for year,	\$128,417.45
		LL. Balance,	68,467.28
I. Total,	\$196,884.73	MM. Total,	\$196,884.73

I. Net cost of works to date	.	.	\$2,232,430.35
J. Bonded debt, Dec. 31, 1895	.	.	1,775,300.00
K. Value of sinking fund	.	.	339,276.00
L. Rate of interest	.	.	34, 34, 4, 44, 5

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	\$66,861
Estimated population supplied,	64,539
Total number of gallons consumed for the year,	1,591,451.913
No. of gallons metered,	215,591,850
Average daily consumption in gallons,	4,360,142
Gallons per day to each consumer,	67.56

DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron
Size,	From 2 to 20 inches in diameter
Extended,	6,304 feet
Total now in use,	108 miles, 1,792 feet
Total now in use,	Lynn, Saugus, Swampscott, 124 miles, 4,030 feet
Number of leaks for the year,	167
Hydrants added,	3
Hydrants now in use,	786
Gates added,	11
Gates now in use,	931
Range of pressure of city for day and night,	50 to 65 pounds

SERVICES.

Kind of pipe used,	iron, cement-lined adamanta and galvanized iron
Size of pipe used,	$\frac{3}{4}$ to 10 inches in diameter
Extended,	14,204
Discontinued,	3,850
Number of services added,	279
Number of services discontinued,	83
Number of services now in use,	11,023
Total length of services,	89 miles, 2,861 feet
Number of services added in Saugus,	66
Number of services now in use in Saugus,	673
Length of services added in 1895,	3,129
Total length of services in Saugus,	6 miles, 2,886 feet
Meters added,	316
Meters now in use,	1,206

251

ANNUAL REPORT

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WATER BOARD

OF THE

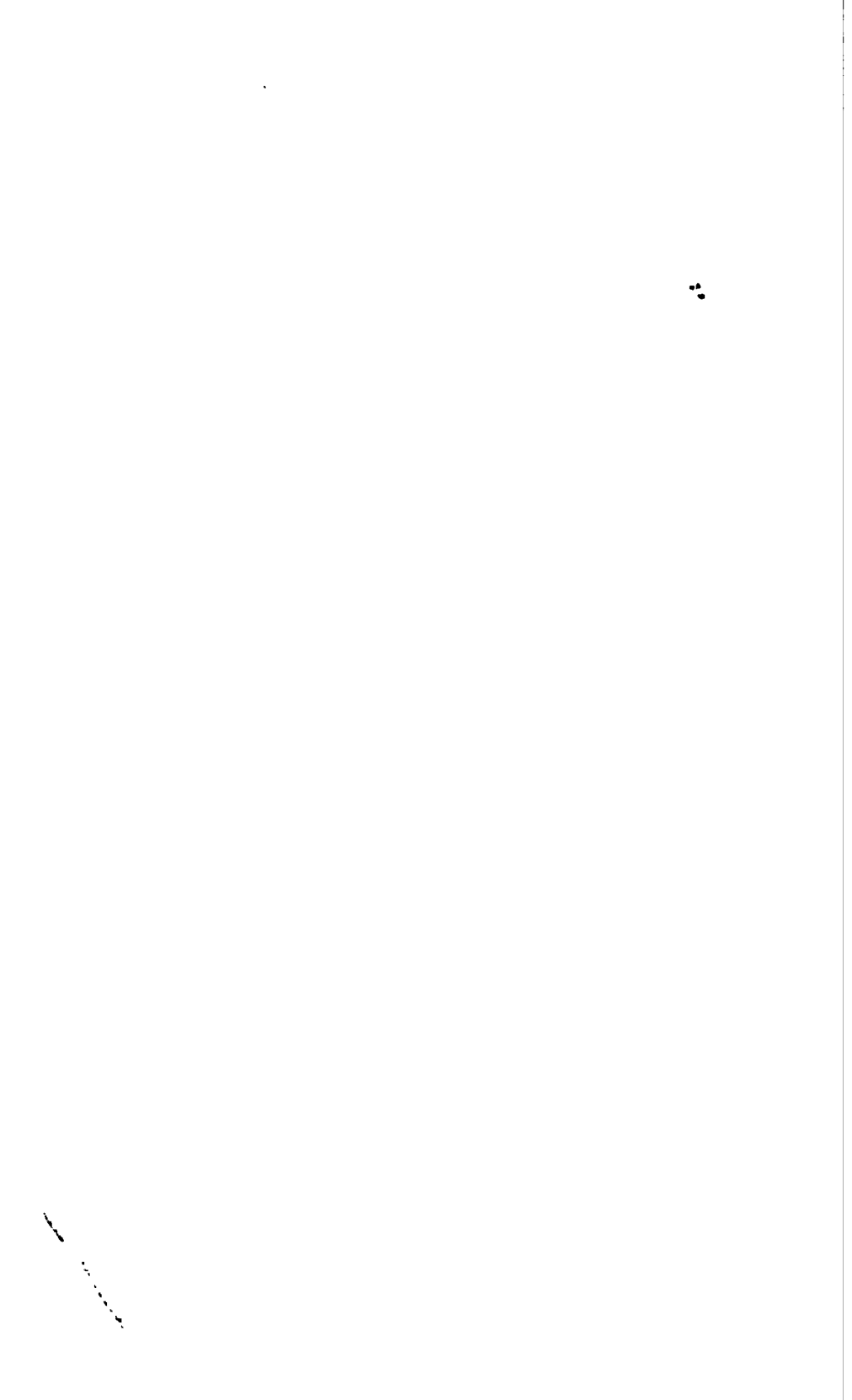
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1896



LYNN, MASS. :
WHITTEN & CASS, PRINTERS.
1897.

1000



ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1896



LYNN, MASS.:
WHITTEN & CASS, PRINTERS.
1897.

R. W. 11.

OFFICERS FOR 1896

D. A. SUTHERLAND,
For one year.

JOHN MACNAIR,
For two years.

THOS. P. NICHOLS,
For three years.

W. B. LITTLEFIELD, *Pres.*
For four years.

JAS. BURNS,
For five years.

Superintendent and Clerk, JOHN C. HASKELL.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, G. S. SANBORN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. McCLAIN.

<i>Inspectors</i>	{	WINSLOW J. ROWELL,
		J. FRANK POOL,
		W. B. MOULTON,
		JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1897

JOHN MACNAIR, for one year.

THOS. P. NICHOLS, for two years.

W. B. LITTLEFIELD, *Pres.*, for three years.

CHAS. O. BEEDE, for four years.

JAMES BURNS, for five years.

ANNUAL REPORT

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1897. }

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-fifth annual report, together with the reports of the Superintendent and Registrar.

Water Supply.

The construction of our system of water supply was commenced in 1870. The first source of supply was Breed's pond, which, when full, has twenty-two feet of water at the dam. It contains 58.45 acres of water surface, a total storage capacity of 262,563,340 gallons, a water-shed, including pond surface, of .93 square miles.

In 1873 Birch pond was added by constructing a dam across the valley of Beaver brook, supplied by a water-shed of .66 square miles.

On June 23, 1883, the city was authorized to take the waters of Hawkes' and Penney brooks, tributaries of Saugus river, and whenever the flow of water in the river should exceed 15,000,000 gallons per day, the excess over said 15,000,000 gallons may be diverted for the use of the city. In the fall of 1883 work was commenced by constructing a canal and tunnel between Saugus

river at Howlett's mill and Birch pond, connecting Hawkes' and Penney brooks, separately, to the main canal, and laying a pipe through the bottom of Birch pond. This work reached completion the following year.

In 1884 Birch pond dam was raised nine feet to its present height, giving 21.50 depth of water at dam, and a pond surface of 82 acres, with a drainage area, including the pond of .66 square miles, a total storage capacity of 381,062,901 gallons. During the year the pipe lines leading from Breed's and Birch ponds to the pumping station were connected.

In 1886 a pumping station was erected at the upper end of Birch pond over the canal, equipped with a steam engine and boiler of 60 horse power, and a Webber 15 inch centrifugal pump capable of pumping 12,000,000 gallons of water daily from the canal into the pond. This became necessary in order to fill Birch and Breed's ponds when they were unable to fill from their own water-shed.

On the 12th of June, 1888, an order was passed by the City Council instructing the Water Board to construct a dam on either Hawkes' brook or Penney brook. The board decided to construct a dam on Penney brook, and thought it advisable to construct a second dam across an arm of Walden pond to give increased depth to the upper end. The pond was called Glen Lewis; both dams were erected in 1889. Walden pond, when full, has 17 feet of water at dam, a pond surface of 128 acres, and a water-shed, including pond surface, of 1.31 square miles, a storage capacity of 403,163,826 gallons.

Glen Lewis pond has a depth of 17 feet, with a pond surface of 36 acres, a water-shed, including pond surface, of .36 square miles, and a storage capacity of 120,475,126 gallons.

The water-shed of these ponds, together with the water-shed of Hawkes' brook, 1.92 square miles, make a total of 5.18 square miles, with a reservoir capacity of 1,167,265,193 gallons.

By an act of Legislature, passed May 27, 1893, authority was given to the City of Lynn to take Saugus river and its tributaries (except Lake Quannapowitt and Crystal Lake in Wakefield) as an additional water supply. This addition comprises a water-shed of 22.91 square miles, with a storage reservoir of

1,167,265,193 gallons capacity and represents our present water supply.

In pursuance of the general development of our present water supply, as required by increased consumption, the following order was passed by the City Council :

IN BOARD OF MAYOR AND ALDERMEN, }
December 4, 1894.

Ordered, That the Water Board be and hereby is authorized to build a storage basin in Hawkes' Brook valley, at a cost not exceeding \$125,000, and that the same be charged to the account of Water Construction.

Under the provisions of this order an additional reservoir has been added to our supply by constructing a dam across the valley of Hawkes' brook. When full, the pond contains a storage capacity of 300,000,000 gallons and covers an area of 75 acres.

The first cost of construction was estimated at \$125,000, which expense covered the amount for land damage and the construction of the dam. Afterwards it was considered best to thoroughly clean the bed of the pond which carried the expense to \$147,-821.02. All soil above the level at which water can waste from the pond was removed; the remaining portion was covered with about one foot of gravel and sand. By thus preparing the bed of the pond the greatest degree of purity should be secured in its waters.

The work of constructing was carried on under the supervision of Lucian A. Taylor, civil engineer, of Worcester, who has had an extensive experience both as an engineer in designing and as a contractor in building works of this description.

This additional reservoir will bring our total storage capacity to 1,467,265,193 gallons—an amount but slightly in excess of what is required for the immediate future, and a short time only should elapse before additional storage capacity should be provided by constructing a dam immediately below the site of the present dam at Walden pond, with 45 feet of water at the dam and a storage capacity of 2,800,000,000 gallons, all upon land owned by the city. It will also be necessary to construct a dam across the upper end of Glen Lewis pond, with 11 feet of water

at dam. To utilize this reservoir it will be necessary to pump the waters of Hawkes' Brook pond elevation into the higher level. The opportunity given the water to stand for a long period in a reservoir of this size would ensure a greater degree of purity.

The work of connecting Saugus river with Hawkes' pond should be commenced as early in the present year as the season will permit. This can be effected by constructing a canal from the river at a point just above the railroad at Montrose, to the upper end of the Hawkes' pond.

Purity of the Water.

Taking the standard adopted by the State Board of Health, viz.: the number of deaths from typhoid fever per 10,000 living population, we find from a table compiled from the census of 1890, showing the death rate from typhoid fever in cities in the United States with over 50,000 inhabitants, that Lynn has the least death rate of any except one of the fifty-four cities, and equally as good as that, and but one-fourth of the general average. This exceptional low death rate shows that we have nothing to fear from the impurity of our water.

Walden Pond.

From its first construction, the water of Walden pond contained algæ growth in large quantities, rendering the water disagreeable in taste and odor. In the summer months no trouble was experienced from its use, from the fact that the water in Breed's and Birch ponds furnished our supply during that period. When the increasing consumption showed that in the immediate future these ponds would become inadequate, it became necessary to furnish additional water of good character, with this purpose in view, the work of improving the bed of Walden pond was commenced.

In the summer of 1894 about eleven acres near the dam was cleaned, and an area of thirteen acres of shallow water was cut off by a dam, a pipe provided with a gate was laid under the dam to permit the use of the water when of sufficient purity. The expense of this work was \$4,506.43. The bed of the pond was burned over, and exposed to alternate freezing and thawing. The beneficial results of this labor will be seen from the fact that

the water remained of good character till July 10, in 1895, while it became unfit for use on May 23, 1894, and May 25, 1893. This additional period during which we were able to use the water, supplemented the amount lacking in Breed's and Birch ponds for the summer of 1895.

The work of improving the bed of the pond was continued in the summer of 1895. The mud and all organic matter was removed from about thirteen acres at a cost of \$6,063.66. In 1896 the work of cleaning the bed of Walden pond was continued. Commencing at the upper end immediately below the Glen Lewis pond dam and cleaning an area of sixteen acres at an expense of \$6,700. The area cleaned is forty acres, cut off thirteen acres, leaving seventy-five acres in an unimproved condition. The entire expense incurred in improving the bed of Walden pond was \$17,270.

A careful study of the water at different points in the brooks which enter the pond showed plainly the location where many noxious germs originated, and the necessity of improving the condition of the water-shed, as well as the bed of the pond, and in 1895 the work of improving the water-shed by draining the swamps was accomplished.

The practical effect of this work became evident in the summer of 1896, when the water of Walden pond retained its good character throughout, furnishing the greater portion of our supply until August 17, when its supply was entirely exhausted.

High Service.

The new high service supply has now been in successful operation for one year; sufficient pressure is given on the highest levels and a greater average pressure is secured over the entire high service than in the low.

Biological.

The biological examinations of the water have been conducted by Miss M. W. McFarlane with sufficient frequency to secure a most intimate knowledge of the organisms present at all times during the year. The purity of the supply is improving.

Street Mains.

Over a mile of cement-lined pipe has been replaced with cast-iron. It is the intention of the board to replace the cement-lined pipe with cast-iron only where the cost of maintenance approaches the interest on the cost of relaying the pipe.

Water Supply for Fire Purposes.

The city of Lynn is exceptionally well provided with a water supply for fire purposes. The water is delivered from the distributing reservoir on Pine Hill by three mains, 30 inch, 24 inch, and 16 inch respectively, to Walnut street at the pumping station.

From the pumping station a 20 inch main extends through Walnut, Winter, Cedar, Mall and North Common streets, City Hall square, Central avenue to Andrew street, and through Liberty from Central avenue to Willow street. A 16 inch main from the pumping station passes through Walnut, North Federal, Marion, Centre, Elm, Summer and Andrew streets, connecting at that point with the 20 inch main, then through Central avenue and Union street to Silsbee street. A 12 inch pipe from the 30 inch main at the pumping station is laid through Walnut, Kirtland, Marion, Federal, and North Common streets, connecting with the 20 inch main at Mall street. A 12 inch main from the reservoir for the high service runs down the Reservoir road to Linwood street, thence through Tapley street, Woodlawn street, Lover's Leap avenue, Forest, North Franklin and Franklin streets, Western avenue to Washington street, where it is connected to the low service and can be used if necessary. In the business part of the city 1,000,000 gallons per hour can be delivered if necessary.

Land Purchased in 1896.

L. F. Viall	5 acres.
J. G. Vickary	4 $\frac{1}{2}$ acres.
Jane E. Newhall	2 $\frac{1}{2}$ acres.
W. O. Newhall, trustee	2 1-16 a.
Estate J. A. Ingalls	1 $\frac{1}{2}$ acres.
Estate S. I. Parker	1 $\frac{1}{2}$ acres.

Statement.

FUNDED DEBT.

Funded loan Dec. 20, 1895	\$1,775,300 00
Bonds issued, 1896	50,000 00
Total	<u>\$1,825,300 00</u>
Bonds matured	50,000 00
Total loan	<u>\$1,775,300 00</u>

SINKING FUNDS.

Amount on hand Dec. 20, 1895	\$265,734 86
Received from treasurer	73,541 14
Income on investments	11,154 90
	<u>\$350,430 90</u>
Paid on matured bonds	50,000 00
Balance in hands of commissioners	\$300,430 90
Balance in hands of treasurer	54,821 39
	<u>\$355,252 29</u>

TREASURER'S STATEMENT.

Received from water rates	\$184,862 34
Received from premiums on bonds	1,000 00
Received from accrued interest on bonds	311 11
	<u>\$186,173 45</u>

EXPENDITURES.

Maintenance	\$58,005 82
Interest	73,346 24
	<u>131,352 06</u>
Net income	\$54,821 39

Respectfully submitted,

W. B. LITTLEFIELD,

President.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
Lynn, Mass., January 1, 1897. }

To Wm. B. Littlefield, President:

SIR,—I herewith present the financial condition of the department for the year ending Dec. 31, 1897.

RECEIPTS.

Fixture rates	\$125,882 74	
Meter rates	48,768 51	
Additional rates	2,164 37	
Miscellaneous rates	7,246 92	
Fines	106 80	
Total revenue	—————	\$184,169 34
For extra pipe, etc.		5,213 13
Total receipts as per cash book		\$189,382 47

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$184,169 34
Amount outstanding, fixture rates	\$12,632 79
Amount outstanding, meter rates	3,247 95
Amount outstanding (not due), meter rates	11,139 31
	—————
	27,020 05
	\$211,189 39
Deduct amount due January 1, 1896	20,658 06
Revenue for the year 1896	\$190,531 33
Revenue for the year 1895	185,572 88
Increase	\$4,958 45

PUBLIC WATER BOARD

11

STATEMENT OF NET EARNINGS FOR 1896.

Revenue	\$190,531 33
EXPENSES.	
Interest	\$73,346 24
Maintenance	54,160 13
Rebate to Saugus	2,982 77
	<hr/>
	130,489 14
Net earnings	\$60,042 19

EXPENDITURES FOR THE YEAR 1896.

MAINTENANCE.

Pumping station	\$11,336 16
Salaries and office expenses	8,835 27
Walden pond	8,055 41
Meters	5,933 87
Mains	5,590 51
Services	5,198 71
Legal expenses, tubular well case	3,500 00
Stable and shop	2,056 65
Engine and boilers	798 31
Incidental expenses	539 95
Damages	485 87
Engine house	459 28
New supply	431 25
Birch pond	369 60
Laboratory	269 22
Tax, "Town of Saugus"	92 40
Pumping, Birch pond	84 91
Breed's pond	78 98
Reservoir	43 78
Total	<hr/>
	\$54,160 13

CONSTRUCTION.

Hawkes' pond	\$53,429 56
New supply (damages)	20,000 00
Highland stand-pipe, and pumping apparatus	11,535 83
Services	9,564 76
Mains	6,641 76
Walden pond "land"	607 50
	<hr/>
	\$101,779 41
Less amount received for pipe, etc.	5,213 13
Net	<hr/>
	\$96,566 28

STATEMENT

SHOWING COST OF WORKS TO JANUARY 1, 1897.

Mains, hydrants and gates	\$835,646 03
New supply and land	337,390 75
Services and courts	283,962 87
Walden and Glen Lewis ponds	184,170 92
Engines and boilers	140,327 29
Reservoirs and land	131,581 49
Hawkes' pond	147,821 21
Birch pond and land	93,471 84
Engine house and land	57,562 39
Breed's pond and land	57,135 28
Pipe conduits and land	45,293 98
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping plant	34,212 07
Highland service	12,431 17
Tubular wells	9,470 02
Engineering	9,246 17
Work shop and stable	2,056 97
	<hr/>
	\$2,460,858 00
Less amount received for pipe	131,861 37
	<hr/>
Total net cost	\$2,328,996 63

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,215	
Number of services in Saugus	750	
Total	<u> </u>	11 965
Number put in during the year (Lynn)	254	
Number put in during the year (Saugus)	78	
Total	<u> </u>	332
Number extended during the year (Lynn)	22	
Number extended during the year (Saugus)	2	
Total	<u> </u>	24
Number discontinued	20	
Number not in use	41	
Turned on (new services)	220	
Turned on (re-occupied)	254	
Turned on (rates and fines paid)	4	
Shut off (for vacancy)	309	
Shut off (for non-payment)	15	
Shut off (for repairs)	75	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
 ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
 CONTAINED IN THE SAME, TOGETHER WITH THE
 NUMBER OF FIRE HYDRANTS, DEC. 31, 1896.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	10,536	704	11,240
Stores and shops	1,187	30	1,217
Factories	173	2	175
Offices	487	17	504
Restaurants and saloons	82		82
School-houses	48	6	54
Churches	28	5	33
Bakeries	32		32
Laundries	20		20
Engine houses	10	3	13
Families	15,741	812	16,553
Boarding-houses	214	2	216
Faucets	28,561	2,403	30,964
Water-closets	12,932	405	13,337
Bath tubs	4,858	257	5,115
Hand hose	2,802	232	3,034
Urinals	184	6	190
Heaters	847	41	888
Stationary engines	155	6	161
Motors	25		25
Greenhouses	16		16
Drinking fountains	29		29
Stand-pipes, fire purposes	16	1	17
Stand-pipes for water-carts	68		68
Sewer connections	20		20
Automatic sprinklers	85	2	87
Hydrants	792	137	929
Hydrants for car sprinklers	31		31

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	.	.	.	\$8,989	00
From January 1, 1872, to January 1, 1873	.	.	.	27,568	15
From January 1, 1873, to January 1, 1874	.	.	.	47,992	61
From January 1, 1874, to January 1, 1875	.	.	.	53,545	61
From January 1, 1875, to January 1, 1876	.	.	.	52,553	26
From January 1, 1876, to January 1, 1877	.	.	.	60,807	12
From January 1, 1877, to January 1, 1878	.	.	.	64,002	50
From January 1, 1878, to January 1, 1879	.	.	.	67,570	14
From January 1, 1879, to January 1, 1880	.	.	.	73,949	80
From January 1, 1880, to January 1, 1881	.	.	.	79,635	12
From January 1, 1881, to January 1, 1882	.	.	.	80,967	76
From January 1, 1882, to January 1, 1883	.	.	.	94,419	52
From January 1, 1883, to January 1, 1884	.	.	.	98,893	54
From January 1, 1884, to January 1, 1885	.	.	.	114,903	86
From January 1, 1885, to January 1, 1886	.	.	.	110,089	11
From January 1, 1886, to January 1, 1887	.	.	.	116,375	70
From January 1, 1887, to January 1, 1888	.	.	.	123,507	73
From January 1, 1888, to January 1, 1889	.	.	.	134,480	27
From January 1, 1889, to January 1, 1890	.	.	.	141,865	53
From January 1, 1890, to January 1, 1891	.	.	.	154,788	27
From January 1, 1891, to January 1, 1892	.	.	.	171,744	85
From January 1, 1892, to January 1, 1893	.	.	.	188,979	88
From January 1, 1893, to January 1, 1894	.	.	.	177,803	56
From January 1, 1894, to January 1, 1895	.	.	.	176,655	50
From January 1, 1895, to January 1, 1896	.	.	.	185,572	88
From January 1, 1896, to January 1, 1897	.	.	.	190,531	33
				<hr/>	
				\$2,798,252	61

FUNDED WATER LOAN

When Payable.	Rate Per Cent.	Amount.
Jan. 1, 1899	5	\$50,000
Jan. 1, 1900	5	50,000
Apr. 1, 1900	4	10,000
Jan. 1, 1901	5	50,000
Mar. 1, 1903	4	8,000
May 1, 1904	3½	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3½	66,500
Dec. 1, 1905	3½	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3½	31,000
Mar. 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3½	6,000
Apr. 1, 1916	3½	2,000
May 1, 1916	3½	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3½	6,500
June 1, 1917	3½	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
July 1, 1925	4	165,000
July 1, 1926	4	50,000
Note (on demand)		100,000
		<hr/>
		\$1,775,300

REPORT OF SUPERINTENDENT.

To Wm. B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1896.

Water Supply.

In November and December, 1895, water was pumped into Birch pond from the canal, a total of 164,000,000 gallons being deemed sufficient with the probable rainfall to fill the pond by July 1.

On January 1, 1896, Breed's pond contained 213,000,000 gallons of water; Birch pond, 285,000,000 gallons; Glen Lewis, 130,000,000 gallons; a total of 628,000,000 gallons, equal to 138 days' supply.

On July 1 we had 855,000,000 gallons in store for the summer months, equal to 188 days' supply, based on the daily consumption for 1896.

The water in Walden pond continued of good character, furnishing the greater portion of our supply until August 17, when it was entirely exhausted.

From this date no water was taken through the canal, Breed's and Birch ponds furnishing the entire supply until November, when water was taken from Glen Lewis pond for the remainder of the year.

Walden Pond.

The work of improving the bed of Walden pond was continued, an area of 16 acres was cleaned at an expense of \$6,700. About one-third of the entire area of the pond has been put in

the best condition, and the remaining portion should be treated in the same manner as soon as is practicable. The work of improving the water-shed was also continued.

Biological.

Weekly microscopical examinations have been continued of the top and bottom water in all of our reservoirs and the tap at the City Hall. While these frequent examinations gave a thorough knowledge of its character, no organisms injurious to health were found present at any time during the year.

Canal.

The sides and bottom of the canal were thoroughly cleaned. Before commencing its use in the fall, the canal and tunnel were thoroughly flushed out.

High Service.

The water was turned into the high service from the new stand pipe situated on Pine Hill on the 24th day of April, giving an additional pressure of 33 pounds. The working of the new pumps have exceeded the duty expected from them. When filled with water the stand-pipe was found to be water tight and is thoroughly acceptable in all directions.

Hawkes' Brook Pond.

During 1895 and 1896 an addition to our storage has been made by constructing a dam across the valley of Hawkes' brook. The pond thus made, when full, has a depth of 25 feet of water at dam; a pond surface of 75 acres; a water-shed including pond surface of 1.92 square miles; storage capacity, 300,000,000 gallons; main dam at crest, 1,350 feet long, 20 feet wide, both slopes two feet horizontal to one vertical; inner slope a loose riprap of about two feet in thickness; outer slope and top of dam to be covered with loam. A core wall extends from bottom to within three feet of top of embankment; from bottom of core wall to top of dam is 55 feet; core wall is founded in solid ledge. There is a wing dam 210 feet long at crest; core and side slope

same as main wall; water at dam, 18 feet. Waste way is at east end of dam, five feet below crest, and was excavated through ledge to the valley below. All soil above the level at which water can waste from the pond has been removed. The gate-house is so arranged that water can be drawn from any desired elevation. Through the main dam there is one 36" and one 30" pipe. Especial care has been taken in the construction of this reservoir towards securing water of the best character.

Pumping Station.

All of the engines are in good running order. The Leavitt has required no extensive repairs during the year. A new flight of stairs has been built for the Leavitt and auxiliary engines connecting both engines by a landing at the top and taking the place of the old stairway that was removed to make room for the auxiliary high service engine.

A new tank has been procured to collect drips and returns from the Loretz engine to heat the feed water pumped to the boiler. A few new valves have been put in the pump to replace broken ones.

The arches at the top of the combustion chambers of the old boilers have been raised and fusible plugs placed in the back heads of the boiler.

The iron feed water heater in the flue of the Moore boiler has rusted out and been replaced with a new one of brass. The roof of the building has been repaired and the joints in the front steps pointed up. A new floor has been laid in the engine-room and new cords put in the windows, also the joints around the window casings have been thoroughly calked and puttied up.

During the year 5,837 feet of cement-lined pipe was taken up and replaced with cast-iron mains in the following streets: Curve, George, Forest Hill, Lowell, Neptune, Stickney, Summer, Vine, and Warren; 2,659 feet of cast-iron pipe have been laid in 12 streets, as petitioned for by the abutters; 147 bursts came in the cement-lined pipe. During the year six gates have been set in connection with the new mains; 31 have been set for the street sprinklers; three new gates replaced old ones; 31 hydrants were

put in for street springling by cars; three new hydrants were put in; seven new hydrants replaced old ones; 32 leaks in hydrants and two leaks in gates were repaired; 104 new main gate boxes were set; 27 main gate boxes were raised where streets were graded; 243 feet of ledge was excavated in trenching for mains in new work and 229 feet in service trenches; 264 services were put in, aggregating 10,154 feet in length; 27 services were extended, a length of 960 feet; 20 were discontinued; 16 services were renewed; 48 services were changed from the old pipe to the new; 992 corporations were drilled out; 140 lead pieces put in place of old ones; 240 iron stop boxes to replace old wooden ones; 272 leaks in service pipes were repaired; 493 services were cleaned out; 75 service boxes were raised; 11 were lowered; 32 services were thawed out; 34 new stop and wastes were put in to replace old ones; 37 private hydrants were repaired; 363 new meters were set; 164 meters were taken out, tested and repaired; 41 meters were changed; 13 new meter boxes replaced old ones; 14 new outside meter boxes were put in; 27 drinking fountains were repaired; 19 stand-pipes were repaired.

The following tables show the work performed by the department during the year.

Respectfully submitted,

JOHN C. HASKELL,

Superintendent.

ANALYSIS OF WATER IN TAP BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.	RESIDUE ON EVAPORATION.				AMMONIA.			NITRO-GEN AS				
Collection.	Examination.	Turbidity.	Sediment.		Color.	Total.	Loss on ignition.	Fixed.	Free.	Total.	Albuminoid.		Nitrates.	Nitrites.		
											In solution.	In suspension.				
Jan. 14	Jan. 15	Slight.		1.00	Faintly vegetable.	Distinctly vegetable	4.75	2.25	2.50	.0008	.0226	.0010	.43	.0070	.0001	8778 1.1
Feb. 11	Feb. 12	Dist'ct clayey	Slight earthy.	0.50	Faintly vegetable.	Distinctly vegetable	4.00	1.50	2.50	.0008	.0146	.0132	.30	.0130	.0001	5538 1.1
Apr. 14	Apr. 15	Very slight.	Slight.	0.37	Faintly vegetable.	Faintly vegetable.	3.55	1.45	2.10	.0030	.0138	.0126	.41	.0030	.0000	4543 1.0
May 12	May 13	Distinct.	Slight.	0.55	Distinctly vegetable	Distinctly vegetable	4.30	1.90	2.40	.0010	.0262	.0182	.57	.0050	.0000	5600 1.4
June 9	June 10	Distinct.	Cons. brown.	0.50	Faintly vegetable.	Faintly vegetable.	4.05	1.65	2.40	.0002	.0248	.0204	.43	.0080	.0001	5478 1.5
July 14	July 15	Distinct.	Cons. rusty.	0.60	Distinctly vegetable and sweetish.	Distinctly vegetable	4.10	1.50	2.60	.0000	.0224	.0192	.50	.0000	.0001	11120 1.3
Aug. 11	Aug. 12	Distinct.	Slight.	0.05	Distinctly vegetable	Distinctly vegetable	4.50	1.95	2.55	.0018	.0324	.0092	.48	.0070	.0000	9204 1.0
Sept. 8	Sept. 9	Very slight.	Cons. brown.	0.30	Faintly vegetable.	Faintly vegetable.	5.35	1.80	3.55	.0008	.0220	.0136	.64	.0070	.0001	3337 1.7
Oct. 7	Oct. 8	Very slight.	Considerable.	0.30	Faintly vegetable.	Distinctly vegetable	4.40	1.30	3.10	.0000	.0208	.0184	.59	.0030	.0002	3752 1.7
Nov. 10	Nov. 11	Slight.	Considerable.	0.42	Faintly vegetable.	Distinctly vegetable	4.65	1.90	2.75	.0000	.0204	.0084	.61	.0070	.0000	5421 1.6
Dec. 8	Dec. 10	Slight.	Slight.	0.42	Distinctly vegetable	Distinctly vegetable	4.90	2.50	2.40	.0006	.0250	.0226	.56	.0090	.0001	6279 1.2

ANALYSIS OF WATER IN HOWLETT'S POND BY STATE BOARD OF HEALTH.

FACTS IN 100,000.

Collection.	Examination.	APPEARANCE.		Color.	ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITROGEN AS		Oxygen consumed.	Hardness.	Iron.		
							Total.	Loss on ignition.	Fixed.	Free.	Total.	Albuminoid.		Nitrates.				Nitrites.	
												In solution.	In suspension.						
Jan. 14	Jan. 15	Slight milky.	Slight.	0.70	Distinctly vegetable and mouldy.	Hot.	8.00	2.75	5.25	.0066	.0214	.0038	1.00	.0600	.0016	68.14	2.7	..	
Feb. 11	Feb. 12	Dist. clayey.	Slight earthy.	0.70	Distinctly vegetable and mouldy.		5.20	1.95	3.25	.0032	.0220	.0190	.0030	.51	.0150	.0003	6.74	2.0	..
Mar. 10	Mar. 11	Slight.	Slight.	0.70	Distinctly vegetable and mouldy.		5.45	2.40	3.05	.0008	.0196	.0184	.0012	.58	.0080	.0001	67.08	1.8	..
Apr. 14	Apr. 15	Very slight.	Slight.	0.68	Veg. and mouldy.		5.20	2.25	2.95	.0018	.0226	.0214	.0012	.52	.0070	.0005	66.22	1.8	..
May 12	May 13	Distinct.	Slight.	1.20	Distinctly vegetable and mouldy.		7.25	3.65	3.55	.0000	.0410	.0358	.0082	.85	.0030	.0003	1.6786	2.5	..
June 9	June 10	Slight.	Slight.	1.30	Distinctly vegetable and mouldy.		8.15	3.55	4.60	.0056	.0442	.0410	.0032	.86	.0030	.0001	1.1504	3.2	..
July 14	July 15	Dist. mouldy.	Slight brown.	0.93	Distinctly vegetable and mouldy.		4.45	1.85	2.60	.0064	.0378	.0282	.0060	.42	.0000	.0002	1.3768	1.1	..
Aug. 11	Aug. 12	Slight.	Slight.	0.90	Distinctly vegetable and unpleasant.		9.20	3.00	6.20	.0084	.0468	.0376	.0032	1.26	.0600	.0001	.8814	3.5	..
Sept. 8	Sept. 9	Slight.	Slight.	0.70	Distinctly mouldy.		10.60	3.20	7.40	.0018	.0412	.0370	.0042	1.19	.0150	.0004	7.27	3.8	..
Oct. 7	Oct. 8	Very slight.	Slight.	1.40	Decidedly mouldy.		9.95	3.50	5.55	.0074	.0482	.0444	.0038	1.01	.0050	.0010	1.5286	3.5	..
Nov. 10	Nov. 11	Slight.	Slight.	1.15	Distinctly vegetable and mouldy.		9.10	3.70	5.40	.0022	.0388	.0372	.0016	1.18	.0300	.0003	1.1310	3.1	..
Dec. 8	Dec. 10	Very slight.	Slight.	0.88	Distinctly vegetable and astringent.		5.40	3.20	5.20	.0050	.0282	.0246	.0036	1.02	.0500	.0002	1.1427	3.0	..

ANALYSIS OF WATER IN BREED'S POND BY STATE BOARD OF HEALTH.

PART IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITROGEN AS		Iron.					
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Albuminoid.			Nitrates.	Nitrites.	Oxygen consumed.	Hardness.	
											Total.	In solution.	In suspension.					
Jan. 14	Jan. 15	Slight.		0.63	None.	Faintly vegetable.	3.95	1.80	2.15	.0072	.0188	.0160	.0028	.51	.0030	.0001	.6660	0.8
Feb. 11	Feb. 12	Very slight.		0.50	None.	Faintly vegetable.	3.50	1.50	2.00	.0038	.0136	.0116	.0020	.44	.0070	.0001	.5811	0.5
Mar. 10	Mar. 11	Slight.		0.70	Faintly vegetable.	Faintly vegetable.	3.85	1.30	2.55	.0026	.0166	.0144	.0022	.49	.0050	.0000	.5850	1.0
Apr. 14	Apr. 15	Slight.		0.38	Faintly vegetable.	Faintly vegetable.	3.60	1.35	2.25	.0002	.0128	.0108	.0020	.40	.0030	.0000	.4389	0.5
May 12	May 13	Distinct green scum.		0.40	Distinctly grassy.	Decidedly mouldy and grassy.	3.25	1.40	1.85	.0014	.0176	.0120	.0056	.53	.0000	.0001	.4150	0.8
June 9	June 10	Slight.		0.35	Faintly vegetable.	Distinctly vegetable.	3.45	1.30	2.15	.0018	.0214	.0198	.0016	.16	.0030	.0000	.4860	0.6
July 14	July 15	Very slight.	Cons. brown.	0.32	Faintly vegetable.	Distinctly vegetable.	3.75	1.35	2.40	.0000	.0170	.0152	.0018	.54	.0000	.0001	.4680	0.7
Aug. 11	Aug. 12	Slight.		0.25	Distinctly vegetable	Distinctly vegetable	3.25	1.15	2.10	.0018	.0192	.0142	.0050	.50	.0000	.0001	.4056	0.6
Sept. 8	Sept. 9	Slight.		0.27	Faintly vegetable.	Faintly vegetable.	3.85	1.30	2.55	.0018	.0194	.0174	.0020	.58	.0000	.0001	.3375	0.9
Oct. 7	Oct. 8	Slight.		0.22	Faintly vegetable.	Distinctly sweetish.	3.30	1.10	2.20	.0016	.0224	.0178	.0046	.57	.0000	.0001	.4092	0.8
Nov. 10	Nov. 11	Slight.		0.33	None.	Very faintly veg'ble	3.25	1.30	1.95	.0026	.0188	.0166	.0022	.50	.0050	.0001	.3666	0.8
Dec. 8	Dec. 10	Slight.		0.38	None.	None.	3.85	1.50	2.35	.0030	.0198	.0164	.0034	.60	.0000	.0001	.4092	0.6

ANALYSIS OF WATER IN GLEN LEWIS POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.	RESIDUE ON EVAPORATION.				AMMONIA.			NITROGEN AS		Oxygen consumed.	Hardness.			
Collection.	Examination.	Turbidity.	Sediment.		Color.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Chlorine.			Nitrates.	Nitrites.	
Jan. 14.	Jan. 15	Distinct.	Slight.	0.33	Distinctly pleasant.	Distinctly pleasant, sweet.	3.55	1.85	1.70	0.118	0.250	0.222	0.028	44	0.030	0.002	4.504	0.2
Feb. 11	Feb. 12	Distinct scum	Slight.	0.30	Distinctly vegetable	Distinctly vegetable and sweetish.	3.15	1.65	1.50	0.034	0.154	0.130	0.022	30	0.070	0.002	4.407	0.2
Mar. 10	Mar. 11	Distinct scum	Very slight.	0.28	Faintly vegetable.	Distinctly vegetable and sweetish.	3.20	1.30	1.00	0.008	0.188	0.144	0.044	40	0.020	0.001	3.167	0.2
Apr. 14	Apr. 15	Distinct.	Slight.	0.25	Faintly vegetable.	Distinctly vegetable	2.75	0.95	1.80	0.000	0.188	0.120	0.068	37	0.020	0.000	2.618	0.5
May 12	May 13	Distinct whitish scum.	Slight green.	0.28	Distinctly grassy and unpleasant.	Distinctly grassy.	2.70	1.40	1.30	0.034	0.260	0.162	0.098	43	0.020	0.000	3.327	0.2
June 9	June 10	Distinct green	Slight green.	0.50	Distinctly grassy and disagreeable.	Distinctly grassy	3.10	1.60	1.50	0.178	0.498	0.324	0.174	12	0.050	0.001	4.972	0.2
July 14	July 15	Decid. green, green scum.	Cons. brown.	0.55	Decidedly grassy and mouldy.	Very decided sweet corn odor.	4.90	2.70	2.20	0.008	2.136	0.662	1.474	38	0.000	0.001	1.0500	0.6
Aug. 11	Aug. 12	Decid. green, much g. scum	Cons. brown.	0.52	Decidedly vegetable and grassy.	Decidedly vegetable sweet and grassy.	4.65	2.50	2.15	0.042	0.710	0.388	0.322	47	0.030	0.000	7.020	0.5
Sept. 8	Sept. 9	Decid. green.	Considerable.	0.37	Distinctly grassy and sweetish.	Decidedly sweet and grassy.	5.10	2.60	2.50	0.016	0.750	0.472	0.278	48	0.050	0.001	4.650	0.4
Oct. 7	Oct. 8	Distinct.	Slight green.	0.25	Distinctly vegetable and grassy.	Decidedly sweet.	4.10	2.30	1.80	0.008	0.492	0.400	0.092	45	0.050	0.002	5.569	0.6
Nov. 10	Nov. 11	Distinct.	Slight green.	0.35	Faintly pleasant.	Distinctly pleasant.	3.95	2.20	1.75	0.116	0.824	0.348	0.476	49	0.050	0.003	5.070	0.8
Dec. 8	Dec. 10	Distinct.	Slight.	0.33	Faintly vegetable.	Distinctly sweetish.	3.75	1.85	1.90	0.112	0.354	0.304	0.050	50	0.080	0.001	5.245	0.5

ANALYSIS OF WATER IN BIRCH POND BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.				AMMONIA.			NITRO-GEN AS						
Collection.	Examination.	Turbidity.	Sediment.	Color.			Total.	Loss on ignition.	Fixed.	Free.	Total.	Albuminoid.		Chlorine.	Nitrates.	Nitriles.	Oxygen consumed.	Hardness.	Iron.
												In solution.	In suspension.						
Jan. 14	Jan. 15	Slight.		0.60	None.	Faintly vegetable.	4.85	2.15	2.70	.0030	.0260	.0224	.0036	.55	.0100	.0001	7238	1.3	..
Feb. 11	Feb. 12	Slight.		0.68	Faint or none.	Faintly vegetable.	4.65	2.05	2.60	.0034	.0214	.0182	.0032	.55	.0150	.0001	6786	1.1	..
Mar. 10	Mar. 13	Dist. scum.		0.58	Faintly vegetable.	Faintly vegetable.	4.75	1.95	2.80	.0030	.0234	.0214	.0020	.53	.0080	.0000	5944	1.6	..
April 14	April 15	Distinct.		0.38	Faintly vegetable.	Faintly vegetable.	4.00	1.50	2.50	.0010	.0188	.0160	.0028	.52	.0030	.0001	4774	0.6	..
May 12	May 12	Distinct.		0.33	Distinctly vegetable and mouldy.	Faintly fishy.	3.10	1.25	1.85	.0002	.0220	.0174	.0046	.58	.0030	.0000	4407	1.0	..
June 9	June 10	Slight.		0.42	Distinctly vegetable	Distinctly vegetable	3.65	1.60	2.05	.0040	.0268	.0228	.0040	.50	.0030	.0001	5870	1.0	..
July 14	July 15	Slight.		0.32	Faintly vegetable and sweetish.	Distinctly vegetable and grassy.	4.10	1.35	2.75	.0000	.0250	.0266	.0044	.62	.0000	.0000	8400	1.0	..
Aug. 11	Aug. 12	Distinct.		0.35	Distinctly vegetable and faintly mouldy.	Distinctly grassy — mouldy.	4.00	1.30	2.70	.0008	.0248	.0224	.0024	.60	.0000	.0001	4836	1.0	..
Sept. 8	Sept. 9	Distinct.		0.37	Distinctly grassy and mouldy.	Distinctly grassy — mouldy.	4.50	1.45	3.05	.0012	.0262	.0248	.0014	.63	.0020	.0000	3675	1.3	..
Oct. 7	Oct. 8	Very slight.		0.34	Faintly vegetable.	Distinct.	3.80	1.35	2.45	.0034	.0230	.0266	.0024	.62	.0030	.0001	4410	0.9	..
Nov. 10	Nov. 11	Distinct.		0.53	Faintly vegetable.	Faintly vegetable.	4.70	2.05	2.65	.0008	.0240	.0058	.0058	.68	.0050	.0002	6100	1.0	..
Dec. 8	Dec. 10	Slight.		0.50	None.	None.	4.60	1.85	2.75	.0010	.0246	.0192	.0054	.62	.0050	.0000	6513	1.1	..

PARTS IN 100,000.

Hof.

ANALYSIS OF WATER IN SAUGUS RIVER BY STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	APPEARANCE.		ODOR.	RESIDUE ON EVAPO- RATION.				AMMONIA.			NITRO- GEN AS		Oxygen consumed.	Hardness.	Iron.	
	Turbidity.	Sediment.		Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.				Nitrates.	Nitrites.
Jan. 14 Jan. 15	Slight.	Slight.		1.05 Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	6.55 3.00 3.55	.0042	.0310	.0264	.0016	.59	.0030	.0000	1.0472	2.6	
Feb. 11 Feb. 12	Dist. clayey	Slight earthy.		0.80 Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	4.75 2.05 2.70	.0004	.0206	.0164	.0012	.44	.0000	.0002	.7020	1.7	
Mar. 10 Mar. 12	Slight.	Slight.		0.70 Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	5.10 2.55 2.55	.0000	.0234	.0220	.0014	.52	.0050	.0000	.6825	0.7	
April 14 April 15	Very slight.	Slight.		0.68 Veg. and mouldy.	Distinctly vegetable and mouldy.	4.50 2.25 2.25	.0010	.0226	.0196	.0030	.40	.0000	.0000	.7045	1.6	
May 12 May 13	Slight.	Slight.		1.70 Distinctly mouldy.	Distinctly vegetable	7.35 3.45 3.90	.0016	.0372	.0356	.0016	.74	.0030	.0000	1.3409	2.3	
June 9 June 10	Very slight.	Slight.		1.40 Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	7.80 3.55 4.25	.0028	.0450	.0408	.0042	.61	.0050	.0001	1.4325	3.2	
July 14 July 15	Slight.	Slight.		1.00 Decidedly vegetable and mouldy.	Distinctly vegetable and mouldy.	8.45 2.90 5.55	.0028	.0360	.0346	.0014	.42	.0000	.0003	1.3600	1.2	
Aug. 11 Aug. 12	Distinct.	Cons. brown.		1.33 Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	9.75 3.85 5.90	.0068	.0416	.0386	.0030	.76	.0000	.0002	1.5210	4.3	
Sept. 8 Sept. 9	Very slight.	Slight.		1.80 Distinctly mouldy.	Distinct astringent.	11.30 4.90 6.40	.0012	.0548	.0480	.0068	.59	.0070	.0001	1.4450	4.1	
Oct. 7 Oct. 8	Very slight.	Considerable.		1.40 Distinctly mouldy.	Distinctly musty.	7.85 3.50 4.35	.0004	.0456	.0430	.0026	.78	.0030	.0001	1.5326	3.1	
Nov. 10 Nov. 11	Very slight.	Slight.		1.25 Faintly vegetable.	Distinctly vegetable and mouldy.	8.15 3.75 4.40	.0004	.0432	.0410	.0022	.70	.0050	.0001	2.1681	2.9	
Dec. 8 Dec. 10	Very slight.	Slight.		1.20 Distinctly vegetable	Distinctly vegetable and mouldy.	8.10 3.70 4.40	.0036	.0440	.0202	.0238	.66	.0080	.0001	1.3221	3.2	

TABLE I.

SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING
DECEMBER 31, 1896.

MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	144,513,274	4,661,719	301,659	. . . . .	67.21	69.43
February	134,035,243	4,621,005	. . . . .	39,814	66.63	68.85
March	128,572,440	4,157,175	. . . . .	464,730	59.94	61.92
April	120,886,830	4,029,561	. . . . .	127,614	58.10	60.02
May	138,264,811	4,460,155	430,594	. . . . .	64.30	66.43
June	150,396,125	5,013,204	553,049	. . . . .	72.28	74.67
July	164,186,375	5,296,335	283,131	. . . . .	76.36	78.89
August	150,506,380	4,855,045	. . . . .	441,290	70.00	72.31
September	131,637,056	4,387,902	. . . . .	467,143	63.26	65.36
October	137,629,324	4,439,656	51,754	. . . . .	64.01	66.13
November	119,367,435	3,978,915	. . . . .	460,641	57.37	59.26
December	141,107,793	4,551,864	572,949	. . . . .	65.63	67.80
Totals and averages . .	1,661,403,086	4,551,789	65.62	67.80

SW to southwest 200 to 250

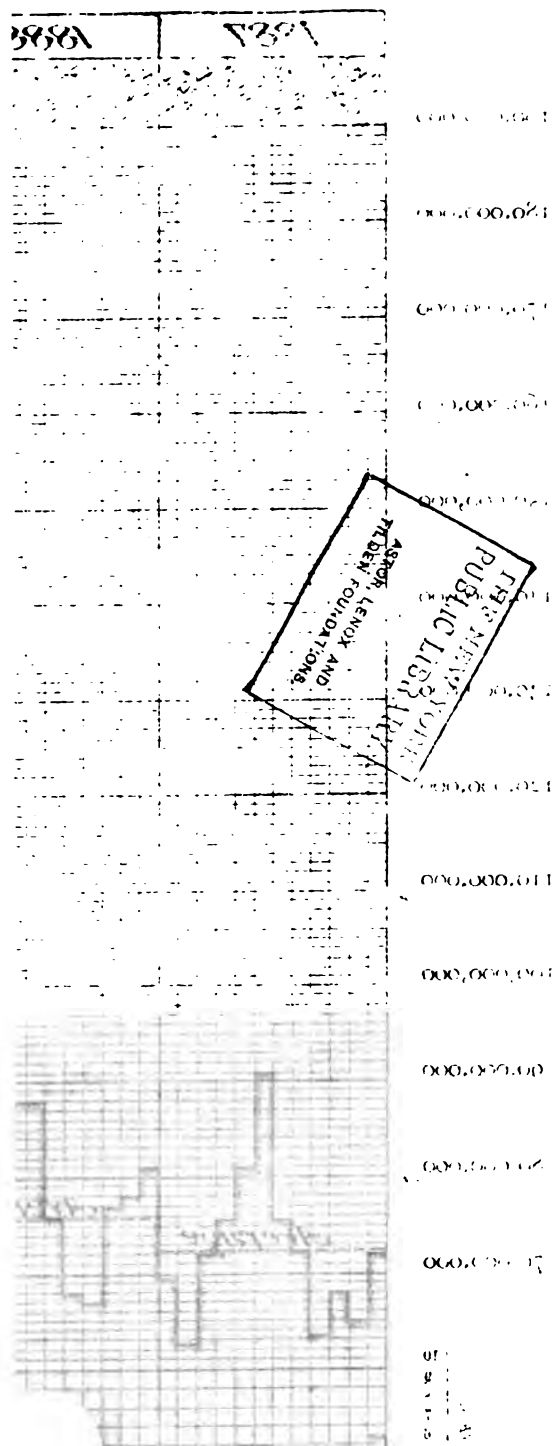
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Diagram showing



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TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1896.

MONTH.	GALLONS.			
	Breed's.	Birch.	Canal.	Total.
January	36,595,162	. . . . .	108,047,025	144,642,187
February	42,243,920	. . . . .	90,373,280	132,617,200
March	70,848,889	. . . . .	58,668,116	129,517,005
April	52,139,322	. . . . .	68,102,943	120,242,265
May	12,526,268	. . . . .	123,460,056	135,986,324
June	23,567,517	. . . . .	129,880,573	153,448,090
July	23,834,040	36,616,500	101,184,310	161,634,850
August	35,637,790	42,253,910	73,374,800	151,266,500
September	721,405	131,169,655	. . . . .	131,891,060
October	1,344,975	136,030,345	. . . . .	137,375,320
November	6,979,477	102,910,090	7,341,535	117,231,105
December	10,772,426	. . . . .	133,682,994	144,455,420
Totals	317,211,191	448,980,500	894,115,635	1,660,307,326

Largest week July 18, 40,076,700 gallons.

Largest day July 3, 8,389,800 gallons.

TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1896.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	0.65	0.50	0.21	..	..	..	0.88	..	0.05	..	..
2	..	..	*0.90	0.45	..	..	..	..	..	0.04	..	..
3	..	*0.03	*0.04	..	..	..	..	..	0.40	..	..	..
4	..	*0.12	*0.11	..	..	..	0.33	..	..	0.08	0.18	..
5	..	0.06	..	..	..	..	..	0.34	0.78	0.33	0.80	..
6	..	1.60	0.03	..	..	..	0.22	0.11	1.16	..	..	..
7	..	0.15	0.27	0.02	..	0.45	0.33	..	..	0.08	..	..
8	*0.60	*0.02	..	..	0.03	0.30	..	..	..	..	0.60	0.77
9	*0.05	0.45	..	..	..	0.23	..	..	1.33	0.03	..	0.14
10	..	..	..	..	..	0.09	..	..	0.54	..	..	..
11	..	..	*0.50	..	0.46	..	..	..	..	..	0.03	..
12	*0.07	..	..	..	..	..	..	..	0.05	0.42	..	..
13	..	*0.50	..	..	..	0.10	..	..	0.22	0.58	*0.80	..
14	..	..	..	..	..	0.04	..	..	..	0.50	..	..
15	..	*0.09	*0.44	..	..	..	0.15	0.01	..	0.02	..	..
16	..	*0.03	*0.77	..	..	..	..	0.02	..	..	..	*0.18
17	..	..	..	0.15	..	0.02	..	..	0.03	..	..	..
18	..	*0.08	..	..	..	..	..	0.04	0.58	0.08	..	..
19	..	*1.00	0.51	0.14	0.30	..	..	0.39	0.41	..	..	..
20	*0.05	..	..	..	..	..	0.21	..	..	..	..	..
21	..	..	..	0.30	0.05	0.02	..	0.08	..	0.02	0.30	..
22	..	..	..	0.27	..	..	0.07	..	0.08	..	..	..
23	..	..	*0.04	..	..	..	..	0.30	..	1.05	..	*0.13
24	1.80	..	..	..	..	..	0.77	..	..	..	..	..
25	*0.03	..	..	..	0.11	..	0.04	..	..	..	0.45	..
26	..	..	..	..	0.10	..	..	..	..	..	0.03	..
27	..	..	..	..	..	..	0.06	..	..	..	..	..
28	..	..	..	0.02	0.48	0.02	0.03	..	..	..	0.49	..
29	..	1.12	0.75	..	..	..	0.05	..	0.48	0.03	*0.19	..
30	..	..	0.11	..	0.50	..	0.27	..	0.02	0.02	..	..
31	*0.03	..	..	..	..	..	..	0.04	..	..	..	..
Total	2.78	5.75	4.97	1.56	2.03	2.17	2.53	2.21	6.08	3.33	3.87	1.22

*Snow.

Total for the year, 38.50.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1896.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	.	.	0.47	0.24	.	.	.	0.74	.	.	.	.
2	.	0.73	*0.68	0.39	.	.	.	0.09	.	0.10	.	.
3	.	.	.	.	.	.	.	.	0.40	0.07	.	.
4	.	*0.16	*0.01	.	.	.	0.36	.	.	0.31	.	0.01
5	.	.	.	.	.	.	.	0.33	0.60	.	.	.
6	.	1.62	.	.	.	.	0.27	0.11	1.08	0.05	0.98	.
7	.	.	*0.25	*0.01	.	0.40	0.33	.	.	.	.	0.77
8	.	.	.	.	.	0.33	.	.	.	.	0.62	0.14
9	*0.05	0.30	.	.	.	0.25	.	.	1.45	.	.	.
10	*0.34	.	.	.	.	0.09	.	.	0.52	.	.	.
11	.	.	*0.33	.	0.43	.	.	.	.	.	.	.
12	*0.05	.	.	.	.	.	.	.	.	0.42	.	.
13	.	*0.45	.	.	.	0.11	.	.	0.21	0.57	*0.57	.
14	.	.	.	.	.	1.03	.	.	.	0.54	.	.
15	.	.	*0.39	.	.	.	0.15	.	.	.	.	*0.08
16	.	*0.11	*0.55	.	.	.	.	.	.	.	.	.
17	.	.	.	0.15	.	.	.	0.01	0.57	0.11	.	.
18	.	*0.05	.	.	0.34	.	.	0.04	0.46	.	.	.
19	.	*0.09	0.39	0.16	.	.	0.21	.	.	.	.	.
20	*0.03	.	.	0.30	0.06	0.04	.	0.05	.	.	0.32	.
21	.	.	.	*0.31	.	.	0.07	0.08	.	1.11	.	*0.06
22	.	.	*0.01	.	.	.	.	.	.	.	.	.
23	.	.	.	.	.	.	0.73	.	.	.	0.37	.
24	1.59	.	.	.	.	.	.	.	.	.	.	.
25	*0.01	.	.	.	.	.	.	.	.	.	.	.
26	.	.	.	.	0.20	.	.	.	.	.	.	.
27	.	.	.	.	.	.	0.03	.	.	.	.	.
28	.	.	.	0.01	0.54	0.04	0.04	.	.	.	0.49	.
29	.	1.03	0.79	.	.	.	0.02	.	0.52	.	.	.
30	.	.	0.04	.	0.51	.	0.17	.	0.01	0.03	*0.19	.
31	.	.	.	.	0.08	.	.	0.06	.	.	.	.
Total	2.02	4.44	3.91	1.57	2.16	2.29	2.43	2.21	5.53	3.31	3.54	1.06

*Snow.

Total for the year, 34.37

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1896.

DATE.	FEET.			
	Breed's Pond.	Birch Pond.	Walden Pond.	Glen Lewis Pond.
January 1	20.2 ¹ / ₂	19.4	.....	17.10
January 6	20.2 ¹ / ₂	19.4	.....	17.10
January 13	20.1	19.4	.....	17.9
January 20	20	19.3 ¹ / ₂	.....	17.8 ¹ / ₂
February 1	20	19.11	.....	17.10 ¹ / ₂
February 8	21.5	20.9 ¹ / ₂	.....	17.6
February 15	21.7 ¹ / ₂	21.	9.9	15.7
February 22	21.4 ¹ / ₂	21.1 ¹ / ₂	10.2	15.11
February 29	21.4	21.3	10.6	16.3
March 2	21.5	21.0	11.	16.9
March 9	20.11	21.11	11.11	17.8
March 16	20.5	22.1 ¹ / ₂	12.6	17.8
March 23	21.1	22.6	13.8 ¹ / ₂	17.1
March 30	21.7	22.9 ¹ / ₂	14.10	17.7
April 4	21.3	22.9 ¹ / ₂	15.3	17.8
April 11	20.3	22.9 ¹ / ₂	16.4 ¹ / ₂	15.11
April 18	20.5 ¹ / ₂	22.9	16.7	16.2
April 25	20.6	22.9	16.7 ¹ / ₂	16.3 ¹ / ₂
May 2	20.6 ¹ / ₂	22.8 ¹ / ₂	16.8	16.5
May 9	20.6 ¹ / ₂	22.8	16.8	16.6 ¹ / ₂
May 16	20.4	22.7	16.5	16.7 ¹ / ₂
May 23	20.2	22.5	15.8	16.10
June 1	20.	22.3	15.	17.
June 9	19.9 ¹ / ₂	22.3	13.7	17.
June 16	19.8	22.1	13.6	17.1
June 23	19.3	21.10	12.7	17.1 ¹ / ₂
June 29	19.	21.8	11.9	17.1 ¹ / ₂
July 6	18.7	21.5 ¹ / ₂	10.7 ¹ / ₂	17.
July 14	18.2	21.1	9.6	17.
July 20	18.1	19.11	9.2	16.11
July 27	17.10	19.10	8.1	16.10 ¹ / ₂
August 1	17.7	19.7 ¹ / ₂	7.1	16.11
August 8	17.4 ¹ / ₂	19.7	5.11	17.
August 15	16.10 ¹ / ₂	19.5 ¹ / ₂	4.2	16.11
August 22	16.1 ¹ / ₂	19.1 ¹ / ₂	.....	16.10
August 29	15.11	18.1 ¹ / ₂	.....	16.9
September 8	16.	16.5 ¹ / ₂	.....	16.10
September 14	16.2	15.3	.....	17.
September 21	16.3	14.4	.....	17.1
September 28	16.3	12.10	.....	17.1
October 3	16.3	11.10	.....	17.1
October 10	16.3	10.8	.....	17.1
October 17	16.5 ¹ / ₂	9.6	.....	17.1
October 24	16.8	8.3	.....	17.4
October 31	16.9	7.9	.....	17.6
November 9	17.2	8.1 ¹ / ₂	.....	17.6
November 16	17.3	8.3	.....	17.6
November 23	17.9	8.6	.....	17.6
November 30	18.2	8.10	.....	17.2
December 7	18.3	9.	.....	16.7
December 14	18.7	9.3	.....	16.
December 21	19.	9.7	.....	15.9
December 28	19.	9.9	.....	13.

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1896.

STREET.	LOCATION.
Adams street . .	On east line of Chestnut street, 26 feet, 6 inches south of north line of Adams street.
Summer street .	On east line of Cottage street, 17 feet south of north line of Summer street.
Hamilton avenue	On east line of Bay View avenue, 17 feet south of north line of Hamilton avenue.
Konomo avenue .	On south line of Broadway, 17 feet west of east line of Konomo avenue.
Lookout terrace .	On south line of Grant street, 17 feet, 6 inches west of Lookout terrace.

TABLE VII.

SHOWING THE LOCATION OF HYDRANTS SET IN 1896.

STREET.	LOCATION.
West Green street	Centre street.
Lynnfield avenue	North end.
Konomo avenue .	380 feet from Broadway.

TABLE VIII.

LEAKS IN PIPES AND HYDRANTS.

MONTH.	SIZE OF MAINS.						Hydrants.
	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	
January	3	4	2
February	2	...	8	8	1
March	3	1	...	4	...
April	2	...	2 ^o	2	9	9	2
May	1	1	1	8	6	1
June	1	...	6	6	...
July	1	4	10	3	3
August	1	8	4	4
September	2	1	...	1	1	4
October	1	...	4	1	2
November	1	2	5	3	7
December	4	3	5
Totals	2	3	13	11	66	52	31

TABLE IX.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE IN 1896.

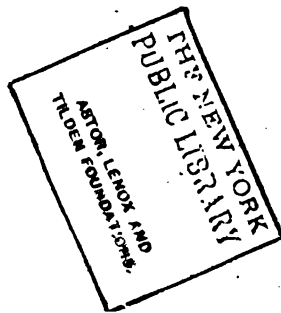
	$\frac{1}{2}$ in.	$\frac{3}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.	2 in.	3 in.	4 in.	Total.
Trident		178	304	30		5	4			521
Thompson Bee		96	268	38		5				407
Thompson		80	115	52		11	2	1	1	262
Ball and Fitz		39	43	19						101
Union			23	12		9	9		15	68
Hersey		22	33	2		1				58
Worthington		5	13	15	3	1	12	1		50
Columbia		25	5	1						31
Weir	1		3	6		8	2			20
Crown	1	1	9	6		2				19
Neptune		9	3				1			13
Nash		2	3	1						6
Empire							3			3
Gem							1			1
Niagara				1						1
Motors										2
Totals	2	457	822	183	3	42	34	2	16	1,561

Total gallons metered, 249,906,830.

TABLE X.
SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICES LAID IN 1896.

MONTH.	SIZE AND LENGTH OF PIPE.												Total.				
	6 in.		4 in.		3 in.		1½ in.		1¼ in.		1 in.			¾ in.			
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.		No.	Feet.		
January																	
February	1	17.6	1	19.	1	31.	4	166.9						5	165.2	5	165.2
March	1	30.4												2	57.4	9	321.7
April																1	30.4
May	22	257.	10	101.6			1	33.7			10	821.	11	437.11	22	1,292.6	
June	1	35.6					2	55.2			8	383.8	22	822.	50	1,045.1	
July											7	237.8	9	357.8	35	1,187.4	
August	1	29.6									15	510.7	18	636.7	42	1,601.11	
September											1	39.	4	88.10	35	1,223.10	
October											1	23.			6	150.10	
November											1	44.9	13	577.2	26	1,104.	
December													5	279.5	20	943.	
													8	487.9	13	889.9	
Totals	26	359.10	11	120.6	28	1082.5	9	716.4	6	224.5	75	3,744.10	109	3,897.	264	10,155.4	

Lynn—27 extensions, 960 feet, 9 inches; 17 renewals. Saugus—75 services, 4,095 feet, 5 inches; 4 services extended, 77 feet.



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43
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40
576
566
180
97
779
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TABLE X.



TABLE XI.

SHOWING THE AMOUNT AND SIZE OF CAST-IRON PIPE LAID IN 1896.

WHERE LAID.	6 in.	4 in.
Abbott street	216	
Adams street	196	
Curve street		*600
Gas-House road	96	
George street		*387
Glenwood avenue	247	
Goodridge street	90	
Forest Hill avenue	*500	
Hamilton avenue	17	
Konomo avenue	904	
Lookout terrace		143
Lowell street	*705	
Neptune street	1,594	
Northern avenue		40
Springfield street	433	
Stickney street		*576
Summer street	*213	
Vine street		*666
Warren street	*506	
Willow street		180
Whitney street		97
Totals	5,717	2,779

*Relaid.

	MILES.	FEET.
Total pipe laid in 1896		8,496
Cement pipe taken up and replaced with cast-iron pipe		5,837
Total extension		2,659
Previously laid	108	1,782
Private pipe in Swampscott		1,788
Pipe in Saugus	16	3,274
Total supplied by the works	125	4,223

SUMMARY OF STATISTICS.

Report of 1896.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1895,

Lynn and Saugus,

66,861

Date of construction,

1870 to 1896

Owned by,

City of Lynn.

Source of supply,

Five artificial storage basins, formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co., of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 11,500,000 daily capacity, one Loretz high service engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek.

2. Cost of coal,

\$3.70 (2,000 lbs.) delivered.

Leavitt and High.

Loretz.

3. Coal consumed for the year, in pounds,

1,146,050

1,598,500

4. Pounds of wood consumed in pounds coal,

3

300

600

	Leavitt and High.	Loretz.
5. Total consumed for the year (3)+(4),		
	1,146,350	1,599,100
6. Total pumpage for the year, in gallons,		
	623,382,276	1,037,462,650
7. Average dynamic head against which pump works,		
	162.30	165.25
8. <i>a.</i> Number of gallons pumped per pound of coal (3)+(4),		
	543.9	648.70
<i>b.</i> Number of gallons raised 100 feet per pound of coal (3)+(4),		
	882.74	1,072.02
9. Duty, in foot pounds per 100 pounds of coal, no deductions,		
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed.}}$		
	73,607,452	89,426,269

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$10,896.56.

10. Per million gallons raised against dynamic head (7) into reservoir,	\$6.55
11. Per million gallons raised one foot high (dynamic),	3.99 cents

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ.:
\$131,352.06.

12. Per million gallons raised against dynamic head (7) into reservoir,	\$79.06
13. Per million gallons raised one foot high (dynamic),	48.16 cents

PUBLIC WATER BOARD

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
<i>From Consumers:</i>			
A. Water rates, domestic,	\$128,047.11	AA. Management and repairs,	\$58,005.82
B. Water rates, manufacturing,	48,768.51	BB. Interest on bonds,	73,346.24
C. Net receipts, for water,	\$176,815.62	CC. Total maintenance,	\$131,352.06
D. Repairs and sundries,	9,357.83	DD. Balance carried to sinking fund,	54,821.39
E. Gross receipts from all sources,		EE. Total,	
	\$186,173.45		\$186,173.45

CONSTRUCTION.

RECEIPTS.	EXPENDITURES.
F. From balance of 1894,	FF. Extension of main lines,
G. Pipes, meters and labor,	GG. Extension of service pipes,
H. Loans,	HH. Highland service,
	II. Account ponds, Hawkes pond,
	JJ. Walden pond, and land bought,
	KK. Riparian rights, Saugus river,
	LL. Total construction for year,
	MM. Balance,
	OO. Total,
I. Total,	
\$123,680.41	\$123,680.41

I. Net cost of works to date, \$2,328,996.63.
 K. Value of sinking fund, \$355,252.29.
 J. Bonded debt, Dec. 31, 1896, \$1,775,300.00.
 L. Rate of interest, 3½, 3¼, 4, 4½ 5.

PUBLIC WATER BOARD

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	69,361
Estimated population supplied,	67,139
Total number of gallons consumed for the year,	1,661,403.086
No. of gallons metered,	249,906.830
Average daily consumption in gallons,	4,551.789
Gallons per day to each consumer,	67.80

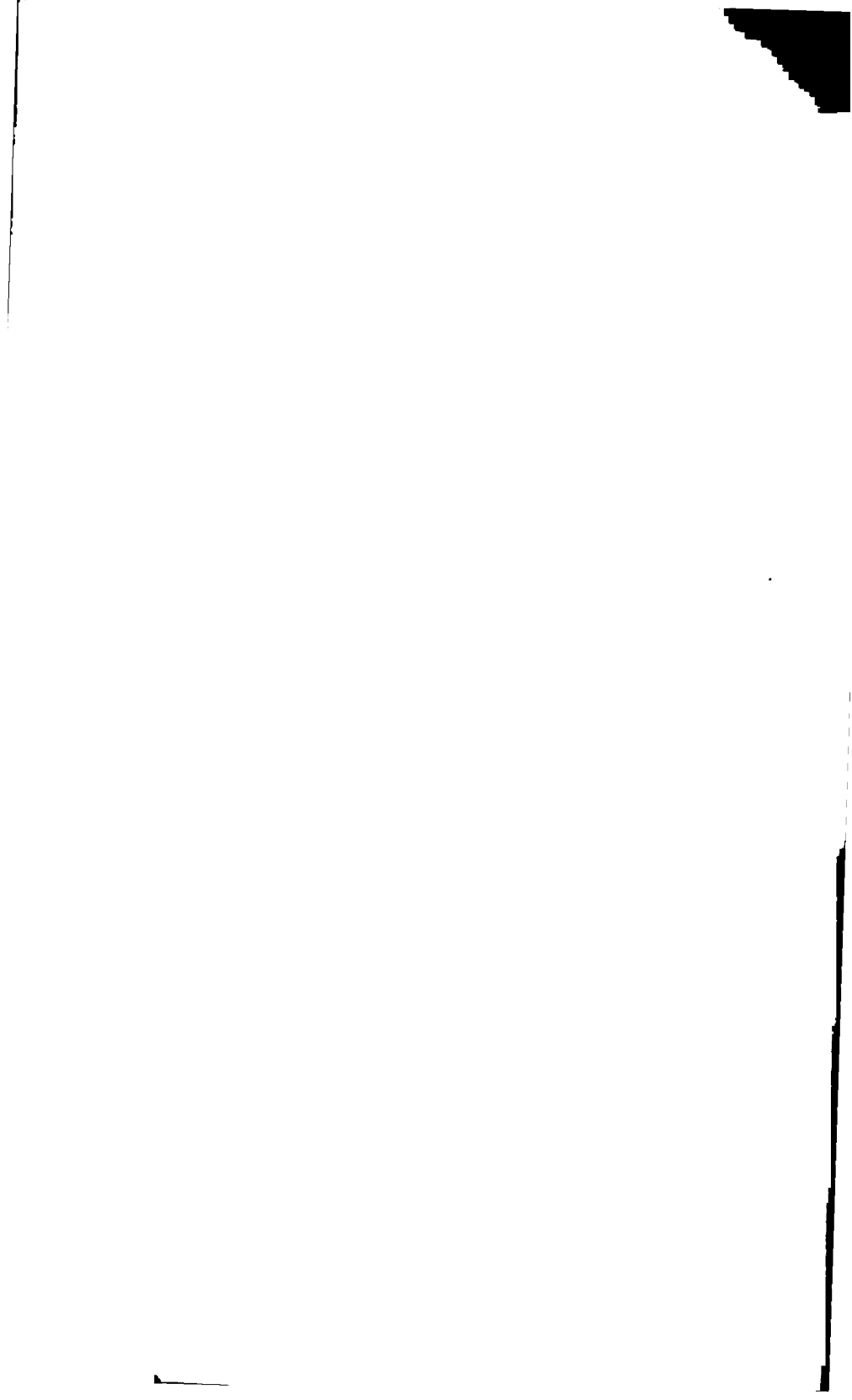
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DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron
Size,	From 2 to 20 inches in diameter
Extended,	2,659 feet
Total now in use,	108 miles, 4,441 feet
Total now in use,	Lynn, Saugus, Swampscott, 125 miles, 4,223 feet
Number of leaks for the year,	146
Hydrants added,	3
Hydrants now in use,	170
Gates added,	5
Gates now in use,	936
Range of pressure of city for day and night,	50 to 65 pounds

SERVICES.

Kind of pipe used,	Iron, cement-lined, adamanta, galvanized iron and lead lined
Size of pipe used,	$\frac{3}{4}$ to 10 inches in diameter
Extended,	11,116
Discontinued,	925
Number of services added,	264
Number of services discontinued,	20
Number of services now in use,	11,267
Total length of services,	90 miles, 4,911 feet
Number of services added in Saugus,	75
Number of services now in use in Saugus,	748
Length of services added in 1895,	4,163
Total length of services in Saugus,	7 miles, 1,749 feet
Meters added,	355
Meters now in use,	1,561



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ASTOR, LENOX AND
TILDEN FOUNDATION

ANNUAL REPORT

OF THE

★ PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1897



LYNN, MASS.:
WHITTEN & CASS, PRINTERS
1898

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ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1897



LYNN, MASS.:
WHITTEN & CASS, PRINTERS
1898

3.1.11

OFFICERS FOR 1897

JOHN MACNAIR,
For one year.

THOS. P. NICHOLS,
For two years.

W. B. LITTLEFIELD, *Pres.*
For three years.

C. O. BEEDE,
For four years.

JAMES BURNS,
For five years.

Superintendent and Clerk, JOHN C. HASKELL.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, G. S. SANBORN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. MCCLAIN.

<i>Inspectors</i> {	WINSLOW J. ROWELL,
	J. FRANK POOL,
	W. B. MOULTON,
	JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1898

THOS. P. NICHOLS, for one year.

W. B. LITTLEFIELD, *Pres.*, for two years.

CHAS. O. BEEDE, for three years.

JAMES BURNS, for four years.

D. A. SUTHERLAND, for five years.



ANNUAL REPORT.

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1898. }

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-sixth annual report, together with the reports of the Superintendent and Registrar.

Water Supply.

The construction of our system of water supply was commenced in 1870. The first source of supply was Breed's pond, which, when full, has twenty-two feet of water at the dam. It contains 58.45 acres of water surface, a total storage capacity of 262,563,340 gallons, a water-shed, including pond surface, of .93 square miles.

Birch pond has a depth of 21.50 feet of water at dam, and a pond surface of 82 acres, with a drainage area, including the pond of .66 square miles, a total storage capacity of 381,062,901 gallons.

In 1886 a pumping station was erected at the upper end of Birch pond over the canal, equipped with a steam engine and boiler of 60 horse power, and a Webber 15 inch centrifugal pump capable of pumping 12,000,000 gallons of water daily from the canal into the pond. This became necessary in order to fill Birch and Breed's ponds when they were unable to fill from their own water-shed.

Walden pond, when full, has 17 feet of water at dam, a pond surface of 128 acres, and a water-shed, including pond surface, of 1.31 square miles, a storage capacity of 403,163,826 gallons.

Glen Lewis pond has a depth of 17 feet, with a pond surface of 36 acres, a water-shed, including pond surface, of .36 square miles, and a storage capacity of 120,475,126 gallons.

The water-shed of these ponds, together with the water-shed of Hawkes brook, 1.92 square miles, makes a total of 5.18 square miles, with a reservoir capacity of 1,167,265,193 gallons.

By an Act of Legislature, passed May 27, 1894, authority was given to the city of Lynn to take Saugus river and its tributaries (except Lake Quannapowitt and Crystal Lake in Wakefield) as an additional water supply. This addition comprises a water-shed of 22.91 square miles.

In pursuance of the general development of our present water supply, as required by increased consumption, the following order was passed by the City Council :

IN BOARD OF MAYOR AND ALDERMEN, }
December 4, 1894.

Ordered, That the Water Board be and hereby is authorized to build a storage basin in Hawkes' Brook valley, at a cost not exceeding \$125,000, and that the same be charged to the account of Water Construction.

Under the provisions of this order an additional reservoir has been added to our supply by constructing a dam across the valley of Hawkes' brook. When full, the pond contains a storage capacity of 300,000,000 gallons and covers an area of 75 acres.

The first cost of construction was estimated at \$125,00, which expense covered the amount for land damage and the construction of the dam. Afterwards it was considered best to thoroughly clean the bed of the pond which carried the expense to \$147,821.02. All soil above the level at which water can waste from the pond was removed ; the remaining portion was covered with about one foot of gravel and sand. By thus preparing the bed of the pond the greatest degree of purity should be secured in its waters.

The work of constructing was carried on under the supervision of Lucian A. Taylor, civil engineer, of Worcester, who has had an extensive experience both as an engineer in designing and as a contractor in building works of this description. This additional

reservoir will bring our total storage capacity to 1,467,265,193 gallons—an amount but slightly in excess of what is required for the immediate future, and a short time only should elapse before additional storage capacity should be provided by constructing a dam immediately below the site of the present dam at Walden pond, with 45 feet of water at the dam and a storage capacity of 2,800,000,000 gallons, all upon land owned by the city. It will also be necessary to construct a dam across the upper end of Glen Lewis pond, with 11 feet of water at dam. To utilize this reservoir it will be necessary to pump the water of Hawkes' Brook pond elevation into the higher level. The opportunity given the water to stand for a long period in a reservoir of this size would ensure a greater degree of purity.

The work of diverting Saugus river into the Hawkes' Brook valley is nearly finished. When the tunnel is completed, and it becomes necessary to take the water of Saugus river, the watershed contributing the supply will contain less than 50 inhabitants to the square mile, and should furnish water of the very best character.

Purity of the Water.

This is a subject of the highest importance for the welfare of our citizens. Such an important factor in the daily life of every individual should be delivered to them in the highest degree of purity possible. To effect this most desirable result a large amount of labor has already been performed in improving the water-shed and cleaning out the beds of the ponds.

It is desirable to still further continue our work in another direction. For some time particular attention has been given to the purification of surface water supplies by filtration. The most comprehensive study of the results to be gained by filtration has been obtained by the State Board of Health during the last ten years at their experiment station at Lawrence.

The value of their experiments may be deduced from the fact that an experimental filter so located as to make it comparable with a large filter of a city supply system has given an average bacterial efficiency of 99.70 per cent. while under continuous operation one year.

The improvement made in the purity of a water supply by filtration is more plainly shown by the effect upon the health of the people of Lawrence from the filter built under the advice of the State Board of Health, and first put in operation September 20, 1893.

This is shown by the following table taken from their report of 1896, giving the deaths from typhoid fever in that city during the period of 1885 to 1896 inclusive :

Deaths from Typhoid Fever in Lawrence, 1885-1896.

YEARS.	TOTAL NUMBER OF DEATHS.	DEATHS PER 10,000 POPULATION.	PERSONS WHO MAY HAVE BEEN EXPOSED TO INFECTION.	
			By drinking canal water.	While living out of town just be- fore falling sick in Lawrence.
1885	17	4.20	...	...
1886	23	5.75	...	...
1887	47	11.75	...	...
1888	48	12.00	...	...
1889	55	13.75	...	...
1890	60	13.33	...	...
1891	55	12.20	...	...
1892	50	11.11	...	...
1893	39	8.66	...	...
1894	24	5.00	12	4
1895	16	3.07	9	2
1896	10	1.86	2	4

To still further improve the quality of our water supply we recommend the filtration through sand, as recommended by the State Board of Health for Lawrence.

Walden Pond.

From its first construction the water of Walden pond contained algæ growths in large quantities rendering it disagreeable in taste and odor to such an extent that during the summer months it became unfit for use.

In 1894 the work of improving the quality of the water was commenced by cleaning out the soil from the bed of a portion of the pond. This work was continued in 1895 and 1896. The entire expense incurred was \$17,270. The swamps in the water-shed were also drained. The practical effect of this work became evident in the summer of 1897 when the water retained its good character throughout the entire year.

High Service.

The new high service supply has now been in successful operation for two years; sufficient pressure is given on the highest levels and a greater average pressure is secured over the entire high service than in the low.

Biological.

Weekly biological examinations have been made of the top and bottom water in all of the reservoirs and from tap at the City Hall during the year. The purity of the supply is improving.

Street Mains.

During the last year cement-lined pipe has been replaced with cast-iron pipe in the following streets:

Summer street from Pleasant to Commercial street. Boston street from Kirtland street to the Saugus line. Mt. Pleasant street and Prospect street.

Water Supply for Fire Purposes.

The city of Lynn is exceptionally well provided with a water supply for fire purposes. The water is delivered from the distributing reservoir on Pine Hill by three mains, 30-inch, 24-inch, and 16-inch respectively, to Walnut street at the pumping station. From the pumping station a 20-inch main extends through

Walnut, Winter, Cedar, Mall and North Common streets, City Hall square, Central avenue to Andrew street, and through Liberty from Central avenue to Willow street. A 16-inch main from the pumping station passes through Walnut, North Federal, Marion, Centre, Elm, Summer and Andrew streets, connecting at that point with the 20-inch main, then through Central avenue and Union street to Silsbee street. A 12-inch pipe from the 30-inch main at the pumping station is laid through Walnut, Kirtland, Marion, Federal, and North Common streets, connecting with the 20-inch main at Mall street. A 12-inch main from the reservoir for the high service runs down the Reservoir road to Linwood street, thence through Tapley street, Woodlawn street, Lover's Leap avenue, Forest, North Franklin and Franklin streets, Western avenue to Washington street, where it is connected to the low service and can be used if necessary. In the business part of the city 1,000,000 gallons per hour can be delivered if necessary.

Land Purchased in 1897.

Estate J. A. Ingalls	6½ acres.
Charlotte F. Parker	14 1-6 a.
Phebe A. Chase	3½ acres.
Rienzi Phillips	1 acre.
G. H. and A. J. Phillips	1 acre.

Statement.

FUNDED DEBT.

Funded loan Dec. 20, 1896	\$1,775,300 00	
Bonds issued in 1897	25,000 00	
Total loan Dec. 20, 1897	<u> </u>	\$1,800,300 00

SINKING FUNDS.

Amount in hands of Commissioners		
Dec. 20, 1896	\$300,430 90	
Received from Treasurer in 1897	54,821 39	
Income from investments	<u>12,108 42</u>	
		\$367,360 71
Amount in hands of Commissioners		
Dec. 20, 1897	\$367,360 71	
Balance in hands of Treasurer, Dec. 20, 1897	<u>43,898 39</u>	
		\$411,259 10

TREASURER'S STATEMENT DEC. 20, 1897.

Received from water rates	\$179,328 88	
Received from premiums on bonds .	2,203 50	
Received from accrued interest on bonds	<u>230 56</u>	\$181,762 94

EXPENDITURES.

Maintenance	\$64,018 31	
Interest	<u>73,846 24</u>	\$137,864 55
Net income		<u>\$43,898 39</u>

Respectfully submitted,

W. B. LITTLEFIELD,

President.

PUBLIC WATER BOARD.

13

STATEMENT OF NET EARNINGS FOR 1897.

Revenue	\$183,711 97
EXPENSES.	
Interest	\$73,846 24
Maintenance	62,431 36
Rebate to Saugus	3,325 65
	<hr/>
	139,603 25
Net earnings	\$44,108 72

EXPENDITURES FOR THE YEAR 1897.

MAINTENANCE.	
Mains	\$14,077 53
Pumping	10,906 29
Salaries and office	9,056 23
Services	6,285 37
Legal, "tubular wells"	5,347 50
Meters	4,940 62
Damages	2,880 35
Stable and shop	2,177 81
Engines and boilers	1,908 06
Pumping, Birch pond	1,742 18
Legal	1,025 74
Conduit	500 55
Walden pond	459 15
Hawkes' pond	289 32
Engine house	267 61
Birch pond	203 23
Reservoir	152 50
Taxes	102 45
Breed's pond	84 12
Glen Lewis	24 75
	<hr/>
	\$62,431 36

CONSTRUCTION.	
Hawkes' Pond canal	\$23,166 17
Mains	7,599 33
Services	5,425 24
Walden pond, land	1,008 50
Compressor	515 00
	<hr/>
	\$37,714 24
Less amount received for extra pipe	2,943 19
	<hr/>
Net	\$34,771 05

STATEMENT

SHOWING COST OF WORKS TO JANUARY 1, 1898

Mains, hydrants and gates	\$843,245 36
New supply and land	337,390 75
Services and courts	289,388 11
Walden and Glen Lewis ponds	185,179 42
Engines and boilers	140,327 29
Reservoirs and land	131,581 49
Hawkes' pond	147,821 21
Birch pond and land	93,471 84
Engine house and land	57,562 39
Breed's pond and land	57,135 28
Pipe conduits and land	45,293 98
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,212 07
Hawkes' pond canal	23,166 17
Highland service	12,431 17
Tubular wells	9,470 02
Engineering	9,246 17
Work shop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,498,572 24
Less amount received for pipe	134,804 56
	<hr/>
Total net cost	\$2,363,767 68

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,374	
Number of services in Saugus	805	
Total	<u> </u>	12,179
Number put in during the year (Lynn)	185	
Number put in during the year (Saugus)	54	
Total	<u> </u>	239
Number extended during the year (Lynn)	20	
Number extended during the year (Saugus)	2	
Total	<u> </u>	22
Number discontinued	20	
Number not in use	25	
Turned on (new services)	180	
Turned on (reoccupied)	231	
Turned on (rates and fines paid)	12	
Shut off (for vacancy)	479	
Shut off (for non-payment)	33	
Shut off (for repairs)	29	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
CONTAINED IN THE SAME, TOGETHER WITH THE
NUMBER OF FIRE HYDRANTS, DEC. 31, 1897.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	10,553	758	11,311
Stores and shops	1,177	39	1,216
Factories	179	2	181
Offices	474	15	489
Restaurants and saloons	80	..	80
School-houses	50	6	56
Churches	28	5	33
Bakeries	32	..	32
Laundries	20	..	20
Engine houses	10	3	13
Families	15,848	866	16,714
Boarding-houses	221	2	223
Faucets	30,108	1,500	31,608
Water-closets	13,272	460	13,732
Bath tubs	5,253	303	5,556
Hand hose	3,055	137	3,192
Urinals	189	8	197
Heaters	850	49	898
Stationary engines	157	6	163
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	29	..	29
Stand-pipes for fire purposes	16	1	17
Stand-pipes for water-carts	72	..	72
Sewer connections	20	..	20
Automatic sprinklers	87	2	89
Hydrants	793	139	932
Hydrants for car sprinklers	35	..	35

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	. . .	\$8,989 00
From January 1, 1872, to January 1, 1873	. . .	27,568 15
From January 1, 1873, to January 1, 1874	. . .	47,992 61
From January 1, 1874, to January 1, 1875	. . .	53,545 61
From January 1, 1875, to January 1, 1876	. . .	52,553 26
From January 1, 1876, to January 1, 1877	. . .	60,807 12
From January 1, 1877, to January 1, 1878	. . .	64,002 50
From January 1, 1878, to January 1, 1879	. . .	67,570 14
From January 1, 1879, to January 1, 1880	. . .	73,949 80
From January 1, 1880, to January 1, 1881	. . .	79,635 12
From January 1, 1881, to January 1, 1882	. . .	80,967 76
From January 1, 1882, to January 1, 1883	. . .	94,419 52
From January 1, 1883, to January 1, 1884	. . .	98,893 54
From January 1, 1884, to January 1, 1885	. . .	114,903 86
From January 1, 1885, to January 1, 1886	. . .	110,089 11
From January 1, 1886, to January 1, 1887	. . .	116,375 70
From January 1, 1887, to January 1, 1888	. . .	123,507 73
From January 1, 1888, to January 1, 1889	. . .	134,480 27
From January 1, 1889, to January 1, 1890	. . .	141,865 53
From January 1, 1890, to January 1, 1891	. . .	154,788 27
From January 1, 1891, to January 1, 1892	. . .	171,744 85
From January 1, 1892, to January 1, 1893	. . .	188,979 88
From January 1, 1893, to January 1, 1894	. . .	177,803 56
From January 1, 1894, to January 1, 1895	. . .	176,655 50
From January 1, 1895, to January 1, 1896	. . .	185,572 88
From January 1, 1896, to January 1, 1897	. . .	190,531 33
From January 1, 1897, to January 1, 1898	. . .	183,711 97
		<hr/>
		\$2,981,964 58

FUNDED WATER LOAN.

When Payable.	Rate Per Cent.	Amount
Jan. 1, 1899	5	\$50,000
Jan. 1, 1900	5	50,000
Apr. 1, 1900	4	10,000
Jan. 1, 1901	5	50,000
Mar. 1, 1903	4	8,000
May 1, 1904	3½	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3½	66,500
Dec. 1, 1905	3½	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3½	31,000
Mar 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3½	6,000
Apr. 1, 1916	3½	2,000
May 1, 1916	3½	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3½	6,500
June 1, 1917	3½	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
July 1, 1925	4	165,000
July 1, 1926	4	50,000
Sept. 1, 1927	4	25,000
Note (on demand)		100,000
		<hr/>
		\$1,800,300

REPORT OF SUPERINTENDENT.

To Wm. B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1897.

Water Supply.

In January, February and March, 1897, water was pumped into Birch pond from the canal, a total of 425,000,000 gallons being deemed sufficient with the probable rainfall to fill the pond by July 1.

On January 1, 1897, Breed's pond contained 181,000,000 gallons; Birch pond, 70,000,000 gallons; Glen Lewis pond, 63,000,000 gallons; Hawkes' pond, 110,000,000 gallons; a total of 424,000,000 gallons; equal to 91 days' supply. On July 1 we had 1,263,000,000 gallons in store for the summer months, equal to 274 days' supply, based on the daily consumption for 1896.

Weekly microscopical examinations have been continued of the water in all of our reservoirs and the tap at the City Hall. The quality of the water was better than in any preceding year.

The supply for the year was taken from the various sources as follows:

Breed's pond	254,351,499 gallons
Birch pond	546,022,515 "
Walden and Hawkes' ponds . . .	894,786,766 "
A total of	<u>1,695,160,780 gallons</u>

This is an increase over 1896 of 35,853,454 gallons. Although Hawkes' Brook pond was filled for the first time, the character of the water was excellent, showing the importance of thoroughly cleaning the bed of a new reservoir.

Hawkes' Pond Canal.

The work commenced in diverting the water of Saugus river at Montrose, at a point just above the railroad to Hawkes' pond at its upper end by means of a canal (consisting of 2,430 feet open canal, 220 feet concrete conduit, 200 feet stone culvert, 730 feet tunnel; having a capacity for delivering about 30,000,000 gallons daily) is approaching completion, and will be ready early in 1898.

Pumping Station.

The engines have required no extensive repairs during the year.

An air compressor has been placed in the engine house to fill the high service air chambers with air to relieve the shocks on the pipe system. A new check valve has been set in the 20-inch force main from the Leavitt engine to replace the old one which has become worn out.

At the January inspection of the two old tubular boilers, the insurance company condemned them as unsafe for further use and the steam pressure was reduced to 70 lbs. They have been used only 23 days during the year, and on December 15 were removed to make room for the new Belpaire boiler which arrived on December 4.

The steam piping in the boiler-room has been changed so that it has a more direct run and is free to expand in all directions. A connection was also made in the main line for the new boiler.

On December 20 the foundation was commenced for the new boilers.

The fence around the back lot has had new posts set and been thoroughly repaired and painted.

During the year 10,684 feet of cement-lined pipe was taken up and replaced with cast-iron mains in the following streets: Summer, Prospect, Mount Pleasant and Boston. Two thousand one hundred and twenty five feet of cast-iron pipe has been laid in 11 streets as petitioned for by the abutters. One hundred and four bursts came in the cement-lined pipe.

During the year six gates have been set in connection with the new mains; four have been set for the street sprinklers; 10 new

gates replaced old ones; four hydrants were put in for street sprinkling by cars; 28 street sprinklers were repaired; 33 hydrants were repaired; 33 leaks in hydrants and 12 leaks in main gates were repaired; 15 new hydrants replaced old ones; 23 main gate boxes were raised where streets were graded; 378 feet of ledge was excavated in trenching for mains in new work, and 73 in service trenches; 185 services were put in aggregating 8,266 feet in length; 20 services were extended, a length of 886 feet; 20 were discontinued; eight services were renewed; 255 services were changed from the old pipe to the new; 853 corporations were cleaned out; 170 lead pieces were put in place of old ones; 104 iron stop boxes to replace old wooden ones; 119 stop boxes reset; 287 leaks in service pipes were repaired; 853 services were cleaned out; 62 service boxes were raised; 21 were lowered; 23 services were thawed out; 38 new stop-and-wastes were put in to replace old ones; 36 private hydrants were repaired; 306 new meters were set; 139 meters were taken out, tested and repaired; 49 meters were changed; seven new meter boxes replaced old ones; eight new outside meter boxes were put in; 17 stand-pipes were repaired.

The following tables show the work performed by the department during the year.

Respectfully presented,

JOHN C. HASKELL,

Superintendent.

ANALYSIS OF WATER IN SAUGUS RIVER BY THE STATE BOARD OF HEALTH. PARTS IN 100,000.

DATE	EXAMINATION	APPEARANCE		ODOR	RESIDUE ON EVAPORATION					AMMONIA			NITROGEN AS		Iron.					
		Turbidity	Sediment		Color	Cold.	Hot.	Total.	Loss on Ignition.	Fixed.	Free.	Total.	In solution.	In suspension.		Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.	Hardness.
Jan. 19 Jan.	20	Slight.			1.30	Faintly fishy	Distinctly fishy	Distinctly fishy		10.40	4.05	5.90	.0006	.0124	.0008	1.8578	1.1			
Feb. 10 Feb.	10	Slight.			1.10	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable		6.55	2.65	5.60	.0004	.0078	.0070	.0008	2.0800	2.2		
Mar. 9 Mar.	10	Very slight.			0.90	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable and mouldy		5.45	2.50	2.95	.0006	.0238	.0000	.0000	2.4400	2.1		
Apr. 13 Apr.	14	Very slight.			1.20	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable		5.60	2.60	3.00	.0006	.0310	.0000	.0000	2.4400	1.5		
May 13 May	14	Very slight.			1.40	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable		6.45	2.65	3.60	.0008	.0350	.0000	.0000	2.4400	2.1		
June 6 June	9	Slight.			1.30	Distinctly vegetable	Distinctly vegetable	Decidedly vegetable		6.45	1.15	3.30	.0008	.0302	.0000	.0000	2.4400	2.7		
July 13 July	14	Very slight.			1.05	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable and mouldy		10.50	4.65	5.85	.0030	.0450	.0000	.0000	2.3500	4.3		
Aug. 10 Aug.	11	Very slight.			1.50	Faintly vegetable	Distinctly vegetable	Distinctly vegetable		8.30	1.60	4.60	.0000	.0400	.0000	.0000	2.4400	1.4		
Sept. 14 Sept.	15	Very slight.			0.85	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable		7.95	1.10	4.65	.0008	.0310	.0000	.0000	2.4400	1.6		
Oct. 13 Oct.	14	Very slight.			0.95	Distinctly vegetable	Distinctly vegetable	Distinctly vegetable		7.85	1.00	4.65	.0008	.0310	.0000	.0000	2.4400	1.6		
Nov. 10 Nov.	12	Slight.			1.27	Faintly musty	Faintly musty	Faintly musty		8.85	4.00	4.85	.0034	.0372	.0000	.0000	2.4400	1.8		
Dec. 14 Dec.	16	Slight.			1.10	None	Faintly mouldy	Faintly mouldy		6.95	2.60	4.00	.0008	.0310	.0000	.0000	2.4400	4.0		

ANALYSIS OF WATER IN HAWKES POND BY THE STATE BOARD OF HEALTH. PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITRO-GEN AS		Oxygen consumed.	Hardness.	Iron.			
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.				Chlorine.	Nitrates.	Nitrites.
Jan. 13	Jan. 20	Slight.		0.75	Distinctly vegetable	Distinctly vegetable	5.80	2.30	3.50	.0012	.0186	.0186	.0000	.70	.0150	.0001	.8103	1.7	..
Feb. 9	Feb. 10	Slight.		0.70	Distinctly vegetable	Distinctly vegetable	5.30	2.20	3.10	.0056	.0238	.0238	.0010	.69	.0180	.0003	.7040	1.6	..
Mar. 9	Mar. 10	Slight.	Very slight.	0.60	Distinctly vegetable	Distinctly vegetable and mouldy.	4.45	1.45	3.00	.0010	.0214	.0166	.0048	.54	.0150	.0002	.5120	1.3	..
Apr. 13	Apr. 14	Very slight.	Very slight.	0.55	Distinctly vegetable	Distinctly vegetable	4.20	1.70	2.50	.0028	.0182	.0152	.0030	.49	.0150	.0002	.5880	1.1	..
May 11	May 12	Very slight.	Very slight.	0.43	Distinctly vegetable	Distinctly vegetable	4.20	1.60	2.60	.0010	.0288	.0212	.0076	.52	.0080	.0001	.5440	1.1	..
June 8	June 9	Very slight.	Very slight.	0.73	Distinctly vegetable	Distinctly vegetable	3.90	1.60	2.30	.0050	.0236	.0218	.0018	.41	.0070	.0003	.6360	1.4	..
July 13	July 14	Very slight.	Very slight.	0.51	Distinctly vegetable	Distinctly vegetable	4.45	1.75	2.70	.0034	.0312	.0198	.0034	.42	.0030	.0003	.7010	1.4	..
Aug. 10	Aug. 11	Very slight.	Very slight.	0.43	Faintly vegetable	Faintly vegetable.	4.20	1.60	2.60	.0012	.0224	.0176	.0048	.46	.0050	.0001	.6150	1.4	..
Sept. 14	Sept. 15	Very slight.	Slight.	0.32	Distinctly vegetable and faintly mouldy	Distinctly vegetable	4.30	1.80	2.50	.0000	.0094	.0230	.0064	.50	.0020	.0000	.5120	1.7	..
Oct. 13	Oct. 14	Very slight.	Very slight.	0.30	Faintly vegetable'e.	Faintly vegetable.	4.20	1.80	2.40	.0018	.0250	.0250	.0000	.49	.0030	.0001	.3840	1.4	..
Nov. 10	Nov. 12	Decided.	Cons.	0.39	Faintly vegetable.	Faintly vegetable.	5.15	2.15	3.00	.0034	.0326	.0226	.0102	.62	.0130	.0002	.4480	2.6	..
Dec. 14	Dec. 15	Slight.	Cons.	0.88	None.	Faintly mouldy.	5.75	2.40	3.35	.0034	.0228	.0000	.0028	.61	.0180	.0001	.7280	2.7	..

ANALYSIS OF WATER IN BREED'S POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	Examination.	Turbidity.	Sediment.	Color.	ODOR.	Hot.	Cold.	RESIDUE ON EVAPORATION.			AMMONIA.			NITRO- GEN AS			Oxygen consumed.	Hardness.	Iron.		
								Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Albuminoid.	Chlorine.				Nitrites.	Nitrates.
Jan. 18 Jan. 19	Very slight.	Slight.	0.42	Faintly vegetable.	Distinctly vegetable	4.45	1.75	2.70	.0076	.0194	.0176	.0018	59	.0050	.0001	.5602	1.1				
Feb. 9 Feb. 10	Very slight.	Very slight.	0.30	Distinctly vegetable and unpleasant.	Distinctly vegetable	4.20	1.70	2.50	.0070	.0160	.0154	.0006	96	.0050	.0002	3600	1.1				
Mar. 9 Mar. 10	Very slight.	Very slight.	0.45	Distinctly vegetable	Distinctly vegetable	3.90	1.40	2.50	.0026	.0144	.0142	.0002	62	.0070	.0000	4200	0.8				
Apr. 13 Apr. 14	Very slight.	Very slight.	0.68	Distinctly vegetable	Distinctly vegetable	3.85	1.40	2.45	.0020	.0160	.0138	.0022	55	.0030	.0001	4800	0.6				
May 11 May 12	Slight.	Very slight.	0.40	Distinctly vegetable and mouldy.	Distinctly vegetable	3.60	1.05	2.55	.0050	.0200	.0176	.0024	57	.0030	.0000	4600	0.8				
June 8 June 9	Very slight.	Slight.	0.58	Distinctly vegetable	Distinctly vegetable	3.35	1.30	2.05	.0014	.0270	.0228	.0042	50	.0000	.0000	5120	0.8				
July 13 July 14	Slight.	Very slight.	0.50	Distinctly vegetable	Distinctly vegetable	1.45	1.30	2.15	.0000	.0218	.0138	.0080	49	.0000	.0000	6177	0.6				
Aug. 10 Aug. 11	Slight.	Very slight.	0.37	Distinctly vegetable and grassy.	Distinctly vegetable	3.40	1.25	2.15	.0006	.0224	.0150	.0074	55	.0030	.0000	5095	0.8				
Sept. 14 Sept. 15	Very slight.	Slight.	0.33	Faintly vegetable.	Faintly vegetable.	3.40	1.05	1.75	.0004	.0180	.0150	.0030	56	.0000	.0000	4480	1.1				
Oct. 13 Oct. 14	Very slight.	Very slight.	0.32	Distinctly vegetable	Distinctly vegetable	3.30	1.30	1.00	.0024	.0254	.0208	.0046	54	.0030	.0001	4080	1.3				
Nov. 10 Nov. 12	Cons.	Cons.	0.38	None.	Faintly vegetable.	9.75	2.00	7.75	.0224	.0212	.0192	.0020	40	.0030	.0000	3840	1.7				
Dec. 14 Dec. 15	Very slight.	Slight.	0.40	None.	Distinctly vegetable	3.75	1.40	2.35	.0020	.0222	.0188	.0034	58	.0000	.0000	4160	1.1				

ANALYSIS OF WATER IN WALDEN POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITROGEN AS		Oxygen consumed.	Hardness.	Iron.		
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.				Nitrates.	Nitrites.
Jan. 18	Jan. 20	Slight.		0.48	Faintly fishy.	Distinctly fishy.	4.95	2.10	2.85	.0046	.0368	.0340	.0028	.53	.0080	.0001	.644	0.9
Feb. 9	Feb. 10	Slight.		0.90	Distinctly vegetable and unpleasant.	Distinctly unpleasant ant.	4.20	1.75	2.45	.0042	.0180	.0150	.0030	.55	.0050	.0000	.604	0.9
Mar. 9	Mar. 10	Very slight.		0.43	Distinctly vegetable and unpleasant.	Distinctly vegetable and sweetfish.	3.60	1.25	2.35	.0004	.0178	.0122	.0056	.44	.0030	.0000	.4720	0.6
Apr. 13	Apr. 14	Slight.		0.48	Distinctly vegetable	Distinctly fishy.	3.35	1.35	2.00	.0026	.0192	.0150	.0036	.41	.0030	.0001	.4880	0.5
May 11	May 12	Very slight.		0.40	Distinctly vegetable	Distinctly vegetable	3.40	1.35	2.05	.0016	.0236	.0186	.0050	.43	.0000	.0000	.5000	0.6
June 8	June 9	Very slight.		0.80	Distinctly vegetable	Distinctly vegetable and mouldy.	3.05	1.50	1.55	.0148	.0268	.0248	.0050	.36	.0030	.0000	.6160	0.3
July 13	July 14	Very slight.		0.63	Distinctly vegetable	Distinctly vegetable	3.40	1.20	2.20	.0040	.0490	.0188	.0302	.41	.0020	.0000	.6591	0.5
Aug. 10	Aug. 11	Slight.		0.72	Distinctly vegetable	Distinctly vegetable and faintly musty	3.90	1.80	2.10	.0006	.0280	.0220	.0060	.38	.0000	.0000	.6600	0.8
Sept. 14	Sept. 15	Cons.		1.10	Distinctly vegetable and mouldy.	Distinctly vegetable	4.45	2.60	1.85	.0002	.0496	.0382	.0114	.47	.0000	.0000	.8000	1.1
Oct. 13	Oct. 14	Very slight.		1.20	Distinctly vegetable	Distinctly vegetable	4.60	2.60	2.00	.0002	.0570	.0490	.0080	.44	.0030	.0001	.8800	0.6
Nov. 10	Nov. 12	Distinct.		1.22	None.	Distinctly vegetable	4.70	2.70	2.00	.0072	.0520	.0512	.0008	.52	.0100	.0004	.8800	1.7
Dec. 14	Dec. 15	Slight.		1.02	None.	Distinctly mouldy.	4.80	2.35	2.45	.0040	.0424	.0384	.0040	.48	.0180	.0001	.8160	1.1

ANALYSIS OF WATER IN GLEN LEWIS POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

Collection.	Examination.	APPEARANCE.			ODOR.	RESIDUE ON EVAPORATION.												
		Turbidity.	Sediment.	Color.		Cold.	Hot.	Fixed.	Loss on ignition.	Free.	Total.	In solution.	In suspension.	Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.	Hardness.	Iron.
Nov. 11	Nov. 12	Slight.	Cons.	0.44 Faintly mouldy	Faintly mouldy	3.90	2.30	1.60	.0030	.0540	.0468	.0073	.46	.0180	.0003	.0630	1.40	...
Dec. 14	Dec. 15	Decided.	Cons.	0.40 Distinctly vegetable and strongly fishy.	Distinctly vegetable and strongly fishy.	3.70	2.10	1.60	.0078	.0580	.0300	.0080	.46	.0070	.0003	.0640	1.30	...

ANALYSIS OF WATER IN HOWLETT'S POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITROGEN AS			Oxygen consumed.	Hardness.	Iron.
Collection.	Examination.	Turbidity.	Sediment.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Chlorine.	Nitrates.				Nitrites.
Jan. 18	Jan. 19	Slight.	Very slight.	1.40	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	9.70	4.00	5.70	.0008	.0404	.0004	.88	.0150	.0001	1.2775	1.2
Feb. 9	Feb. 10	Very slight.	Slight.	0.70	Distinctly vegetable and mouldy.	Faintly unpleasant.	5.75	2.05	3.70	.0064	.0250	.0022	.78	.0080	.0001	.5600	1.7
Mar. 9	Mar. 10	Very slight.	Very slight.	0.88	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	5.65	2.00	3.65	.0044	.0260	.0050	.60	.0150	.0002	.6080	1.9
Apr. 13	Apr. 14	Very slight.	Very slight.	1.10	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	6.25	2.55	3.70	.0014	.0314	.0000	.73	.0130	.0002	.9200	1.9
May 11	May 12	Slight.	Very slight.	1.30	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	7.10	3.05	4.05	.0024	.0340	.0000	.76	.0070	.0000	1.1680	2.3
June 8	June 9	Very slight.	Very slight.	1.40	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	7.00	3.30	3.70	.0036	.0380	.0346	.59	.0070	.0002	1.1200	2.6
July 13	July 14	Very slight.	Slight.	1.75	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.	10.55	4.05	6.50	.0030	.0390	.0276	.68	.0020	.0000	2.0272	4.3
Aug. 10	Aug. 11	Slight.	Very slight.	1.20	Faintly vegetable.	Distinctly vegetable and faintly musty.	8.15	3.60	4.55	.0044	.0428	.0368	.60	.0000	.0000	1.2015	3.2
Sept. 14	Sept. 15	Very slight.	Very slight.	0.60	Distinctly vegetable and faintly musty.	Distinctly vegetable and faintly musty.	6.95	3.00	3.95	.0056	.0340	.0328	.90	.0000	.0000	.6560	3.1
Oct. 13	Oct. 14	Very slight.	Very slight.	0.63	Distinctly vegetable and fishy.	Distinctly vegetable and fishy.	8.05	3.00	5.05	.0032	.0336	.0330	1.26	.0050	.0003	.6840	5.3
Nov. 10	Nov. 12	Slight.	Slight.	0.80	Musty.	Distinctly musty.	8.00	3.10	4.90	.0110	.0360	.0336	.97	.0150	.0008	.6160	3.5
Dec. 14	Dec. 15	Decided.	Cons.	1.02	Faintly vegetable.	Distinctly vegetable and earthy.	7.75	2.65	5.10	.0094	.0322	.0258	.96	.0380	.0006	.8400	3.5

ANALYSIS OF WATER IN BIRCH POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

Collection.	Examination.	Turbidity.	Sediment.	APPEARANCE	TEMPERATURE.	RESIDUE ON EVAPORATION.		AMMONIA.		NITROGEN AS							
						Total.	Loss on ignition.	Fixed.	Total.	In solution.	In suspension.	Chlorine.	Nitrates.	Nitrates.	Oxygen consumed.	Hardness.	Iron.
Jan. 15 Jan. 19	Very slight.			Slight.	0.80	Faintly vegetable and mouldy	4.00	1.00	0.050	0.134	0.016	0.044	27	0.050	0.000	0.110	0.5
Feb. 6 Feb. 10	Slight.			Cons.	0.75	Distinctly vegetable and mouldy	5.00	1.30	0.054	0.138	0.060	0.078	27	0.050	0.000	0.000	1.0
Mar. 9 Mar. 10	Very slight.			Very slight.	0.30	Distinctly vegetable and unpleasant	4.05	1.85	0.034	0.030	0.014	0.016	66	0.070	0.000	0.000	1.2
Apr. 13 Apr. 14	Very slight.			Very slight.	0.60	Distinctly vegetable	5.45	1.00	0.045	0.030	0.016	0.016	60	0.000	0.000	0.000	1.2
May 11 May 12	Very slight.			Slight.	0.42	Distinctly vegetable	5.30	1.60	0.010	0.024	0.072	0.052	24	0.070	0.000	0.000	1.2
June 8 June 9	Very slight.			Slight.	0.60	Distinctly vegetable and grassy	4.00	2.05	0.034	0.060	0.012	0.010	24	0.050	0.000	0.000	1.8
July 13 July 14	Slight.			Very slight.	0.45	Distinctly vegetable and faintly mouldy	4.80	1.00	0.000	0.075	0.016	0.080	24	0.000	0.000	0.000	1.2
Aug. 10 Aug. 11	Slight.			Slight.	0.30	Distinctly vegetable	4.65	1.85	0.005	0.028	0.070	0.052	67	0.000	0.000	0.000	1.2
Sept. 14 Sept. 15	Very slight.			Slight.	0.40	Distinctly vegetable	4.55	1.00	0.035	0.010	0.010	0.010	67	0.000	0.000	0.000	1.2
Oct. 13 Oct. 14	Very slight.			Very slight.	0.50	Distinctly vegetable	4.75	1.05	0.035	0.034	0.034	0.030	67	0.050	0.000	0.000	1.4
Nov. 10 Nov. 12	Slight.			Slight.	0.40	Faintly vegetable	4.45	1.20	0.075	0.010	0.034	0.034	27	0.050	0.000	0.000	1.8
Dec. 14 Dec. 15	Very slight.			Cons.	0.32	None	4.15	1.25	0.000	0.010	0.034	0.000	65	0.010	0.000	0.000	1.0

ANALYSIS OF WATER IN THE TAP BY THE STATE BOARD OF HEALTH.

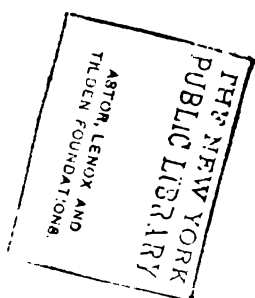
PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITRO- GEN AS		Oxygen consumed.	Hardness.	Iron.			
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.				In suspension.	Chlorine.	Nitrates.	Nitrites.
Jan. 18	Jan. 20	Very slight.		0.47	Faintly fishy.	Distinctly vegetable and faintly fishy.		5.55 2.05 3.50	.0006	.0220	.0240	.0016	.53	.0120	.0002	.5548	1.6	..
Feb. 15	Feb. 16	Very slight.		0.60	Distinctly vegetable and mouldy.	Distinctly vegetable		4.30 1.60 2.70	.0034	.0194	.0194	.0000	.70	.0100	.0001	.5680	1.3	..
Mar. 9	Mar. 10	Very slight.		0.65	Distinctly vegetable and mouldy.	Distinctly vegetable and mouldy.		5.10 1.85 3.25	.0012	.0192	.0184	.0008	.71	.0080	.0000	.5520	1.7	..
Apr. 13	Apr. 14	Very slight.		0.53	Distinctly vegetable	Distinctly vegetable		5.40 1.65 3.75	.0006	.0180	.0180	.0000	.63	.0120	.0001	.5600	1.7	..
May 11	May 12	Very slight.		0.68	Distinctly vegetable	Distinctly vegetable		5.05 1.80 3.25	.0000	.0214	.0176	.0048	.68	.0080	.0000	.6320	1.9	..
June 8	June 9	Very slight.		0.70	Distinctly vegetable	Distinctly vegetable		7.00 2.10 4.90	.0012	.0210	.0210	.0030	.60	.0070	.0000	.4920	2.3	..
July 13	July 14	Very slight.		0.62	Distinctly vegetable	Distinctly vegetable		4.00 1.30 2.70	.0014	.0164	.0164	.0026	.42	.0050	.0001	.5906	1.3	..
Aug. 10	Aug. 11	Slight.		0.51	Faintly vegetable.	Faintly vegetable.		4.35 1.60 2.75	.0006	.0238	.0160	.0078	.48	.0030	.0000	.4950	1.6	..
Sept. 14	Sept. 15	Very slight.		0.32	Faintly vegetable.	Faintly vegetable.		4.10 1.85 2.25	.0004	.0170	.0136	.0034	.49	.0020	.0000	.4160	1.7	..
Oct. 13	Oct. 14	Very slight.		0.32	Faintly vegetable.	Distinctly vegetable		4.10 1.35 2.75	.0005	.0182	.0162	.0020	.52	.0030	.0001	.3680	2.3	..
Nov. 10	Nov. 12	Slight.		0.39	None.	None.		4.55 1.60 2.95	.0020	.0188	.0170	.0018	.70	.0090	.0001	.3120	2.0	..
Dec. 14	Dec. 15	Slight.		0.48	Faintly vegetable and fishy.	Strongly fishy.		4.35 1.90 2.45	.0026	.0247	.0210	.0032	.64	.0150	.0001	.5600	1.7	..

TABLE I.

SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING
DECEMBER 31, 1897.

MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	139,979,997	4,518,355	. . . . .	39,606	66.01	68.22
February	128,443,005	4,537,250	74,092	. . . . .	67.10	69.36
March	130,194,778	4,199,832	. . . . .	387,418	61.44	63.59
April	127,167,590	4,235,572	36,040	. . . . .	62.01	64.09
May	134,257,931	4,330,901	92,029	. . . . .	63.35	65.48
June	144,193,245	4,806,442	475,541	. . . . .	70.31	72.67
July	161,327,076	5,204,119	397,677	. . . . .	76.13	78.68
August	162,693,059	5,257,535	53,419	. . . . .	76.91	79.41
September	157,409,607	5,246,656	. . . . .	10,552	76.75	79.33
October	153,031,500	4,965,532	. . . . .	281,454	72.63	75.08
November	123,245,373	4,118,179	. . . . .	557,353	60.00	62.11
December	131,224,022	4,233,033	124,854	. . . . .	61.92	64.00
Totals and averages.	1,704,257,150	4,741,804	. . . . .	. . . . .	67.59	70.16



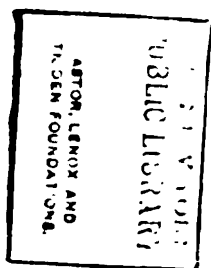


TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1897.

MONTH.	GALLONS.			
	Breed's.	Birch.	Canal.	Total.
January	13,562,325	61,265,685	63,840,690	138,668,700
February	54,210,595	72,408,855	. . . . .	126,619,450
March	13,599,314	118,546,021	. . . . .	132,145,335
April	58,681,094	13,343,741	57,582,550	129,607,385
May	16,009,350	58,438,275	56,608,475	131,056,100
June	40,761,432	50,287,450	53,461,868	144,510,750
July	9,516,324	. . . . .	153,662,436	163,178,760
August	19,484,560	. . . . .	142,092,552	161,577,112
September	7,848,255	. . . . .	149,116,845	156,965,100
October	11,060,790	3,732,750	139,137,960	153,931,500
November . . . . .	. . . . .	108,060,928	15,501,950	123,562,878
December	9,617,460	59,938,810	63,781,440	133,337,710
Totals	254,351,499	546,022,515	894,786,766	1,695,160,780

Largest day, December 21, 7,597,700.

Largest week, September 11, 39,792,300.

TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1897.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	*0.08	..	0.12	..	0.02	..	0.30	..	1.42	..
2	0.10	..	0.20	..	..	..	0.42	..	0.05	..
3	0.03	..	0.20	0.03	..	..	..	..	*0.05	..
4	..	0.28	..	0.22	..	0.47	..	0.61	..	..	..	0.35
5	..	0.47	0.27	0.05	..	..	..	0.04	..	..	0.15	..
6	..	0.25	..	..	..	0.02	..	..	..	..	..	..
7	..	0.05	..	0.45	..	..	..	..	..	0.01	0.24	..
8	0.43	..	0.00	..	..	..	..	0.16	..
9	0.90	0.03	..	..	..	..	..	0.50	0.05
10	0.02	..	0.72	1.87	0.02	..	..	..	..	..
11	0.03	0.12	0.12	..	0.05	0.05	..	0.01	1.15	..
12	..	*0.90	0.17	0.20	0.20	..	0.25	..	..	0.25	0.32	0.37
13	0.05	0.05	0.27	0.18	..	0.12	..	..	1.80
14	*0.35	0.10	0.02	0.05	..	0.15	..	..	0.65	0.27
15	0.16	0.12	..	..	0.25	..	..	0.21	..
16	0.13	..	..	0.02	0.04
17	0.24	..	..	0.12	..	..	..	0.72	0.05	..	..	..
18	0.40	..	..	0.25	..	..	..	..	*0.08	..
19	0.32	..	..	0.32	..	..	..	..	*0.30	0.18
20	*0.40	*0.08	..	..	0.20	..	0.02	..	0.47	..	..	..
21	0.91	0.65	..	0.05	*0.32	0.03
22	0.09	*0.60	0.40	..	..	..	..	0.02	0.52	..	..	..
23	0.25	..	0.54	..	0.35	1.40	0.04	..	..	..
24	0.26	..	..	..	..	0.04	..
25	0.22	..	..	0.38	*0.20
26	0.03	0.30	..	..	..	..	..	..	..
27	*0.35	..	..	..	0.04	..	1.12	..	..	..	..	..
28	*0.54	..	..	..	0.16	0.95	0.27	..	..	..	0.10	*0.05
29	0.30	0.08	..	..	..	..	..	..
30	0.06	..	0.06	..	..	..	..	0.60
31
Total	2.37	1.88	2.39	2.49	3.89	4.70	3.25	4.25	2.14	0.32	6.05	4.23

*Snow.

Total for the year, 38.05.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1897.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	..	*0.04	..	0.12	..	..	..	..	..	1.53	..
2	..	..	0.08	..	0.93	..	..	..	0.72	..	0.72	..
3	..	..	..	..	0.23	0.02	..	..	..	..	..	*0.04
4	0.28	0.33	..	0.23	..	0.42	..	0.77	..	..	..	0.32
5	0.47	0.03	0.20	0.05	..	0.02	..	..	..	..	0.09	..
6	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	0.50	..	..	..	..	..	..	..	*0.24
8	..	..	..	0.54	..	0.02	..	..	..	..	0.17	..
9	..	..	0.02	0.99	0.01	1.75	..	..	..	..	0.58	..
10	..	..	..	*0.06	0.73	0.06	..	..	..	..	..	..
11	..	..	..	0.03	..	..	0.07	0.05	..	0.02	*1.79	..
12	..	*0.17	0.09	..	0.34	0.16	0.16	..	0.13	0.21	*0.38	0.30
13	..	..	..	..	0.05	0.32	0.20	..	..	..	..	..
14	..	..	*0.32	0.16	0.01	0.15	..	0.43	..	..	..	1.66
15	..	..	..	0.15	0.05	..	..	0.30	..	..	0.03	0.23
16	..	0.04	..	..	..	..	..	0.28	0.03	..	0.16	..
17	0.23	..	..	0.12	..	..	..	..	..	..	..	0.01
18	..	..	..	..	..	..	..	0.60	..	..	..	..
19	..	..	0.34	..	..	0.22	..	..	..	..	*0.08	..
20	*0.47	*0.08	0.27	..	..	0.18	..	..	0.49	..	*0.19	*0.18
21	0.11	..	..	..	0.20	..	..	..	..	0.06	..	..
22	*0.05	*0.57	..	..	..	..	0.98	0.79	..	..	*0.15	*0.01
23	..	..	0.47	..	..	..	..	0.02	0.49	..	..	..
24	..	..	0.37	..	0.68	..	0.19	1.71	0.02	..	..	..
25	..	..	..	0.02	..	0.28	0.01	..	..	..	0.01	..
26	..	..	..	..	..	..	..	..	0.30	..	0.29	*0.17
27	*0.34	..	..	0.07	0.33	..	..	..	..	..	..	..
28	*0.07	..	..	..	0.01	..	1.38	..	..	..	..	..
29	..	..	..	..	0.22	1.05	0.11	..	..	..	0.07	*0.03
30	..	..	..	..	0.32	0.05	..	..	..	..	..	..
31	..	..	..	..	0.02	..	..	0.11	..	..	..	*0.54
Total	2.02	1.23	2.20	2.92	4.25	4.54	3.10	5.06	2.18	0.29	6.24	3.73

*Snow.

Total for the year, 37.76.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1897.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Lewis Pond.
January 4	12.6	18.10 $\frac{1}{2}$	10.	6.6	11.2
January 11	13.10	19.2	10.3	6.6	11.2
January 18	14.3	19.1	10.2 $\frac{1}{2}$	6.2 $\frac{1}{2}$	11.2
January 25	15.	19.1 $\frac{1}{2}$	11.10	6.8	11.2
February 1	15.4 $\frac{1}{2}$	19.3 $\frac{1}{2}$	13.5	6.8	11.2
February 8	16.2	19.3	15.	6.6	11.2
February 15	12.7	18.4	17.6	6.8	11.2
February 22	14.10	19.4	17.	7.3	11.2
March 1	15.7	18.2 $\frac{1}{2}$	20.1	7.8 $\frac{1}{2}$	11.2
March 8	17.3	19.1	21.3	8.6	11.2
March 15	19.	19.11	21.8	9.0 $\frac{1}{2}$	11.2
March 22	20.6	20.8	21.5 $\frac{1}{2}$	10.8	11.2
March 29	22.8	21.7	21.8	12.	11.2
April 3	23.2	20.11	21.11	12.2	11.2
April 10	25.5 $\frac{1}{2}$	20.11	22.3 $\frac{1}{2}$	12.10	11.2
April 17	24.11	21.6	22.6	13.4	11.2
April 20	24.11 $\frac{1}{2}$	21.1 $\frac{1}{2}$	22.5	13.10	11.2
May 1	24.11 $\frac{1}{2}$	21.	22.6	13.11	11.2
May 8	24.8	20.11 $\frac{1}{2}$	22.6	14.2	11.2
May 15	24.11	21.5	22.6	14.4 $\frac{1}{2}$	11.2
May 22	24.10 $\frac{1}{2}$	21.6	21.10	14.6	11.2
May 29	24.11	21.8	22.4	14.9	11.2
June 5	24.11	21.4	22.10	14.10	11.2
June 12	25.2	21.9	23.1	15.10	11.2
June 19	24.11 $\frac{1}{2}$	21.	22.10	15.11	11.2
June 26	24.10	20.11	22.8 $\frac{1}{2}$	15.9	11.2
July 5	24.9	20.10	22.7	15.2	11.2
July 12	24.9	20.5	22.5	14.2	11.2
July 19	24.7	20.2	22.3	13.6	11.2
July 26	24.5	20.	22.2	12.6	11.2
August 2	24.10	20.	22.4	12.	11.2
August 9	24.6	19.9	21.11	11.3	11.2
August 16	24.4 $\frac{1}{2}$	19.6	21.9 $\frac{1}{2}$	10.5	12.9
August 23	24.3	19.4	21.9	9.5	12.9 $\frac{1}{2}$
August 30	24.2	19.1	21.8	9.2	12.10
September 6	21.10	18.10	21.5	8.10	12.10
September 13	20.3	18.5	21.3	9.	12.10 $\frac{1}{2}$
September 20	18.11	18.1	21.	9.	12.10 $\frac{1}{2}$
September 27	17.5	17.11	21.	9.	12.11
October 2	16.	17.9	20.11	9.	13.
October 9	14.3	17.6	20.9	8.11	13.
October 16	12.	17.1	20.7	8.10	12.11
October 23	8.9	16.8	20.3	8.9	12.9 $\frac{1}{2}$
October 30	6.	16.5	20.1 $\frac{1}{2}$	8.6	12.9
November 8	7.3 $\frac{1}{2}$	16.9 $\frac{1}{2}$	19.	8.11 $\frac{1}{2}$	13.
November 15	8.6	17.4	18.6	9.4	13.6
November 22	8.9	17.6	18.	9.7	13.10
November 29	9.10	17.10	17.4	9.10	14.3
December 4	11.6 $\frac{1}{2}$	18.1 $\frac{1}{2}$	16.4	10.10	14.7
December 11	11.1	18.1	15.8	11.2	15.
December 18	14.6	18.7	15.8	11.6	16.2
December 25	15.6	19.8	15.8	11.2	16.4

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1897.

STREET.	LOCATION.
Cook street.....	On south line of Grant street, 16 feet, 6 inches north of east side of Cook street.
Fiske street	On west line of Marianna street, 13 feet west of east side of Fiske street.
Mt. Pleasant street	On east line of Ridgeway street, 15 feet south of north line of Mt. Pleasant street.
Raddin's court....	On east line of Raddin's court, 48 feet south of north side of Boston street.
Summer street....	On east line of Blossom street, 17 feet south of north side of Summer street.

TABLE VII.

LEAKS IN PIPES AND HYDRANTS.

MONTH.	SIZE OF MAINS.							Hydrants.
	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	
January	3	4	4
February	2	..	..	..	..	..	..
March	1	..
April	1	..	1	5	3
May	1	..	..	..	2	3	5
June	1	..	6	4	..
July	1	1	5	8	2
August	2	9	1	..
September	1	..	1	..	1	4	1	2
October	2	4	6	2
November	1	1	..	1	3	9	10
December	3	3	5
Totals	1	4	2	3	7	40	45	33

TABLE VIII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE IN 1897.

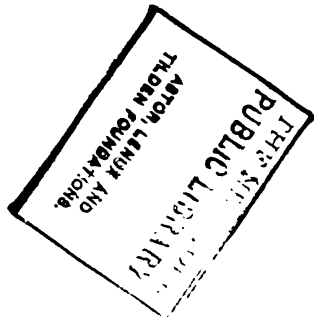
	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.	2 in.	3 in.	4 in.	Total.
Trident		226	415	40	...	6	4	...	...	691
Thomson Bee		95	265	40	...	5	...	...	...	405
Thomson		85	121	53	...	10	2	1	1	274
Hersey		64	40	2	...	1	1	...	...	108
Ball and Fitts		40	40	18	...	...	...	...	...	98
Union		1	27	13	...	8	6	...	15	70
Nash		36	13	1	...	...	...	...	...	50
Worthington		3	10	12	3	1	11	1	...	41
Columbia		31	5	...	...	...	...	...	...	36
Niagara		11	14	1	...	...	...	...	...	26
Weir	1	...	3	4	...	10	2	...	...	20
Lambert		10	8	...	...	...	...	...	...	18
Crown	1	1	7	6	...	2	...	...	...	17
Neptune		7	3	...	...	...	...	...	...	10
Empire . . . . .		...	...	...	...	...	3	...	...	3
Gem . . . . .		...	...	...	...	...	1	...	...	1
Motors	2	...	...	...	...	...	...	...	...	...
Totals	2	611	971	190	3	43	30	2	16	1,868

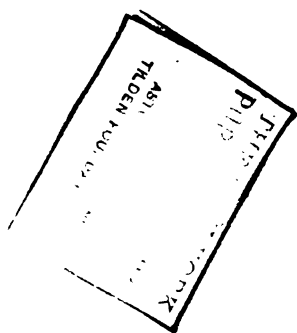
Total gallons metered, 270,236,000.

TABLE IX.
SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICES LAID IN 1897.

MONTH.	SIZE AND LENGTH OF PIPE.														TOTAL.	
	6 in.		4 in.		2 in.		1 1/4 in.		1 in.		3/4 in.		1/2 in.			
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.
March . . . . .	..	..	..	..	..	..	..	..	1	127.	1	47.	..	..	2	174.
April . . . . .	..	..	1	76	4	70.3	1	69.7	9	492.6	16	585.3	..	..	31	1,225.1
May	1	23.1	1	23.	1	31.	1	326.	8	428.8	12	459.	1	23.4	25	1,314.1
June . . . . .	..	..	..	..	..	..	..	..	6	214.4	5	126.6	2	72.	13	412.10
July	4	..	..	..	..	..	1	40.	5	341.3	12	563.4	1	28.10	23	973.5
August . . . . .	..	..	..	..	..	..	..	..	10	432.10	8	252.6	..	..	18	685.4
September . . . . .	..	..	..	..	..	..	1	37.	13	873.4	15	704.10	1	19.	30	1,634.2
October . . . . .	..	..	..	..	..	..	..	..	12	491.8	5	208.9	1	30.4	18	730.9
November . . . . .	..	..	..	..	2	84.8	..	..	4	307.1	4	130.10	3	79.	13	601.7
December . . . . .	..	..	..	..	..	..	..	..	7	291.7	5	223.5	..	..	12	515.
Totals	5	23.1	2	30.6	7	185 11	4	72.7	75	4000.3	83	3301.5	9	252.6	185	8,266.3

Lynn—20 extensions, 885 feet; 8 renewals. Saugus—54 services, 2,347 feet; 2 services extended 152 feet.

[illegible]



77.

1 in.

. . .
 . . .
 . . .
 257
 138
 84
 . . .
 134
 209
 *30
 . . .
 . . .
 108
 *176
 36

1,172

r.
 39
 34
 25
 52
 38
 37
 27

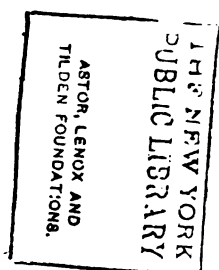


TABLE X.

SHOWING THE AMOUNT AND SIZE OF CAST-IRON PIPE LAID IN 1897.

WHERE LAID.	16 in.	10 in.	8 in.	6 in.	4 in.
Boston street		*4,860	*1,116	*24	...
Cook street				120	...
Eastern avenue				271	...
Fiske street					257
Garfield avenue				454	138
Gertrude street					84
Glenwood avenue				82	...
Hayes avenue				36	134
Lakeview place					209
Mt. Pleasant place				*834	*30
Pine Grove avenue				106	...
Prospect street				*820	...
Rock avenue					108
Summer street	*2,682		*23	*119	*176
Whitney street					36
Totals	*2,682	*4,860	*1,139	2,956	1,172

*Relaid.

10,684 feet relaid; 2,125 feet new.

	MILES.	FEET.
Total pipe laid in 1897		12,809
Total cement pipe taken up and replaced with cast-iron pipe,		10,684
Total extension		2,125
Previously laid	108	1,782
Private pipe in Swampscott		1,788
Pipe in Saugus	17	1,037
Total supplied by the works	126	327

SUMMARY OF STATISTICS.

Report of 1897.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1895.

Lynn and Saugus,

66,861

Date of construction,

1870 to 1897

Owned by

City of Lynn

Source of supply,

Five artificial storage basins, formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co. of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 11,500,000 daily capacity, one Loretz high service engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek

2. Cost of coal,

\$3.70 (2,000 lbs.) delivered.
Leavitt and High. Loretz.

3. Coal consumed for the year, in pounds,

567,300 2,285,150

4. Pounds of wood consumed in pounds coal,

3

900

	Leavitt and High.	Loretz.
5. Total consumed for the year (3)+(4),		
6. Total pumpage for the year, in gallons,	567,300	2,286,050
7. Average dynamic head against which pump works,	271,907.330	1,423,543.150
8. a. Number of gallons pumped per pound of coal (3)+(4),	172.16	166.72
b. Number of gallons raised 100 feet per pound of coal (3)+(4),	479.30	628.80
9. Duty, in foot pounds per 100 pounds of coal, no deductions.	825.17	1,047.82
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed.}}$	75,091,203	86,867,596

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$11,219.25.

10. Per million gallons raised against dynamic head (7) into reservoir,	\$6.61
11. Per million gallons raised one foot high (dynamic),	3.94 cents

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ.:
\$137,864.55.

12. Per million gallons raised against dynamic head (7) into reservoir,	\$81.37
13. Per million gallons raised one foot high (dynamic),	48.55 cents

RECEIPTS.		EXPENDITURES.	
<i>From Consumers:</i>			
A. Water rates, domestic,	\$122,761.67	AA. Management and repairs,	\$64,018.31
B. Water rates, manufacturing,	50,258.34	BB. Interest on bonds,	73,846.24
C. Net receipts, for	\$173,020.01	CC. Total maintenance,	\$137,864.55
D. Repairs and sundries,	8,742.93	DD. Balance carried to sinking fund,	43,898.39
E. Gross receipts from all sources,	\$181,762.94	EE. Total,	\$181,762.94

PUBLIC WATER BOARD.

J. Bonded debt, Dec. 31, 1897, \$1,800,300.00.
L. Rate of Interest, 3½, 3¾, 4, 4½, 5.
I. Net cost of works to date, \$2,363,676.68.
K. Value of sinking fund, \$411,349 10.

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	68,300
Estimated population supplied,	66,000
Total number of gallons consumed for the year,	1,694,258,389
No. of gallons metered,	270,236,000
Average daily consumption in gallons,	4,641,804
Gallons per day to each consumer.	70.16

DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron
Size,	From 2 to 20 inches in diameter
Extended,	2,125 feet
Total now in use.	109 miles, 1,286 feet
Total now in use,	Lynn, Saugus, Swampscott, 126 miles, 327 feet
Number of leaks for the year,	146
Hydrants added,	1
Hydrants now in use,	171
Gates added,	6
Gates now in use,	942
Range of pressure of city for day and night,	50 to 65 pounds

SERVICES.

Kind of pipe used,	
Iron, cement-lined, adamanta, galvanized iron and lead lined	
Size of pipe used,	$\frac{3}{4}$ to 10 inches in diameter
Extended,	9,151
Discontinued,	870
Number of services added,	185
Number of services discontinued,	20
Number of services now in use,	11,374
Total length of services,	92 miles, 2,632 feet
Number of services added in Saugus,	54
Number of services now in use in Saugus,	802
Length of services added in 1897,	2,499
Total length of services in Saugus,	7 miles, 4,248 feet
Meters added,	307
Meters now in use,	1,868

1912

27th

ANNUAL REPORT

OF THE

★ PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1898



LYNN, MASS. :
WHITTEN & CASS, PRINTERS
1899

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LYNN, MASS. :
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1899

OFFICERS FOR 1898

THOS. P. NICHOLS,
For one year.

W. B. LITTLEFIELD, *Pres.*
For two years.

C. O. BEEDE,
For three years.

JAMES BURNS,
For four years.

D. A. SUTHERLAND,
For five years.

Superintendent and Clerk, JOHN C. HASKELL.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, G. S. SANBORN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. MCCLAIN.

<i>Inspectors</i>	{	WINSLOW J. ROWELL,
		J. FRANK POOL,
		W. B. MOULTON,
		JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1899

W. B. LITTLEFIELD, *Pres.*, for one year.

S. W. DEARBORN, for two years.

JAMES BURNS, for three years.

D. A. SUTHERLAND, for four years.

THOS. P. NICHOLS, for five years.

ANNUAL REPORT.

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1899.

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-seventh annual report, together with the reports of Superintendent and Registrar.

Water Supply.

The construction of our system of water supply was commenced in 1870. The first source of supply was Breed's Pond, which, when full, has twenty-two feet of water at the dam. It contains 54.85 acres of water surface, a total storage capacity of 262,563,340 gallons, a water-shed, including pond surface, of .93 square miles.

Birch pond has a depth of 21.50 feet of water at dam, and a pond surface of 82 acres, with a drainage area, including the pond of .66 square miles, a total storage capacity of 381,062,901 gallons.

In 1886 a pumping station was erected at the upper end of Birch pond over the canal, equipped with a steam engine and boiler of 60 horse power, and a Webber 15-inch centrifugal pump capable of pumping 12,000,000 gallons of water daily from the canal into the pond. This became necessary in order to fill Birch and Breed's ponds when they were unable to fill from their own water-shed.

Walden pond, when full, has 17 feet of water at dam, a pond

surface of 128 acres, and a water-shed; including pond surface, of 1.31 square miles, a storage capacity of 403,163,826 gallons.

Glen Lewis pond has a depth of 17 feet, with a pond surface of 36 acres, a water-shed, including pond surface, of .36 square miles and a storage capacity of 120,475,126 gallons.

Hawkes' pond has a depth of 25 feet, with a pond surface of 75 acres, a water-shed, including pond surface, of 1.92 square miles and a storage capacity of 300,000,000 gallons. This total area of 5.18 square miles of water-shed has a total storage area of 1,467,265,193 gallons.

By an Act of Legislature passed May 27, 1894, authority was granted to the city of Lynn to take Saugus river and its tributaries except Lake Quannapowitt and Crystal Lake in Wakefield as an additional water supply. This addition comprises a water-shed of 22.91 square miles or over four times as great an area as that required at present to supply our yearly consumption.

In the general development of our present water supply, a conduit has been constructed from Saugus river to Hawkes' pond, commencing at the river from a point just above the railroad at Montrose, and running to the upper end of Hawkes' pond. This conduit consists of 2,430 feet of open canal, 220 feet concrete conduit, 200 feet stone culvert and 730 feet tunnel, having a capacity for delivering 30,000,000 gallons of water daily from the Saugus river to Hawkes' pond.

It has not yet been necessary to divert any water through the conduit as the supply of water from the old source has been sufficient in quantity during 1898 and will be sufficient for all demands for the year 1899.

The water-shed contributing this supply contains less than 50 inhabitants to the square mile and is entirely free from all direct sewage contamination.

To improve the quality of the water from this area, the entire bed of the Saugus river has been lowered and thoroughly cleaned of all obstructions that might serve to impede the flow or injure the character of the water.

The work of draining all swamps within the water-shed was commenced in 1898 and will be prosecuted to its completion during the summer of 1899.

To fully protect the purity of the water supply from sewage contamination, the surroundings of every dwelling situated upon the water-shed contributing the water supply were thoroughly examined. All vaults so situated that an overflow of their contents might be washed by rains or melting snows into the brooks or water courses were newly constructed by the Water Department, in a thoroughly water tight manner and have been under supervision to prevent their overflow and in no instance have they been full since their construction. To still further show the slight danger of infection from this source, there has not been a case of typhoid fever for two years upon this water-shed.

Purity of the Water.

Early in the year attention was called to the purity of our water supply by the presence of the inspectors of the State Board of Health who came for the purpose of determining the relation of the water supply to the cases of typhoid fever which annually occur and which were deemed by them to be unusually prevalent at the time of their visit.

The result of their investigations was summarized in a report accepting the waters of Breed's, Birch, Walden, Glen Lewis and Hawkes' ponds as suitable water for domestic use and recommending the filtration of the Saugus river water and that measures be taken to prevent the use of ice from polluted sources. With a view to determine the number of cases of typhoid fever, that might be caused by the public water supply, the Water Board decided to institute a careful investigation of every case of typhoid fever occurring as soon as reported when all of the facts pertinent to the case could be ascertained. A general list of questions was prepared covering the principal features liable to contribute to an infection of typhoid fever.

The following blank shows the form adopted :

TYPHOID FEVER IN CITY OF LYNN.

Typhoid Fever Case No....., in the City of Lynn, since Jan 1,.....
(year.)

Date when case was reported,.....

Date of physician's first visit,.....

Date of patient's going to bed,

Date of maximum temperature during illness,

Name of attending physician,

Name of patient, Age, years

Residence,

(If patient has moved during a period of two months ending with date of

sickness, please state former and present residences and date or dates of removal.)

Place of business

(State all places of business occupied during two months ending with date of illness.)

Occupation,

(If changed during two months ending with date of illness, state changes, with dates of such changes.)

Ride bicycle,

School or other public or private institution attended,

(During period of two months ending with date of illness.)

General health,

Health before attack,

Exposed to fever,

Trips out of town

(Information should cover, with dates, all places visited during a period of at least two months ending with date of illness.)

Uncooked food

Sources { At home,
(State whether the public supply is used or water from private or semi-private wells, springs, etc.)

of Water { At place or places of business

Supply: { At school, etc.,

Out of town,

Sources { In town

(Give names of all dealers of whom milk has been obtained by patient

of Milk { during a period of two months ending with date of illness.)

Supply: { Out of town

Ice { Dealer or dealers,

Supply: { Source or sources,

Previous cases in house,

(Names of persons and dates of illness.)

Other cases near by,

(Names of persons and dates of illness.)

Condition of plumbing in house,

Condition of premises,

Doctor's opinion of origin,

No. days in bed,

*Remarks

*(Remarks should embody all additional information which can be obtained relative to special or unusual conditions affecting this case.)

Of the fifteen deaths occurring from typhoid fever during the year of 1898, six were imported from out of town, five were secondary infection or from cases entirely independent from the water supply, and four were of unknown origin, in no case either among the deaths or of those that recovered was there one that could be traced to the water supply.

To show the purity of the water as relating to typhoid fever, we will quote from the latest report of the State Board of Health, page 11, the following information bearing on this point:

"The death rate of any community from typhoid fever is a most important index of the sanitary condition of such community. While a high death rate from this cause continuing for a short period and affecting a limited portion of the community may be due to an infected milk supply or some unsanitary local conditions, a persistently high typhoid death rate recurring year after year usually indicates a polluted water supply."

From a table on page 12 we find that during the period of five years from 1886 to 1890 inclusive that of the 32 cities in Massachusetts but two had a less death rate from typhoid fever and Lynn had but forty-eight one hundredths (.48) of the general average. During the period of five years from 1891 to 1895 inclusive of the 32 cities, six had a lower death rate from typhoid fever and the death rate for Lynn was but sixty-five one hundredths (.65) as great as the general average. We also find from a table compiled from the census of 1890 showing the death rate from typhoid fever in cities in the United States with over 50,000 inhabitants that Lynn has the least death rate from typhoid fever of any, except one of the fifty-four cities and equally as good as that, and but one-fourth of the general average.

We will now compare the purity of the water supply for 1898 with the only other source from which it would be possible to procure a different supply, namely the Metropolitan water supply. The death rate in Boston from typhoid fever in 1898 was 3.31 per 10,000 living; Lynn, 2.27; the death rate in Lynn being but sixty-eight one hundredths (.68) as great as in Boston.

We will now consider the disagreeable character of the two supplies as shown from the monthly examinations of the State Board of Health in 1898 of water taken from a faucet in Boston

and from a faucet in Lynn. The average number of disagreeable organisms found per cubic centimeter in Boston, 208; in Lynn, 46; the Lynn water having twenty-two one hundredths (.22) as many disagreeable organisms as the Boston water. This later comparison is most significant when compared with the only standard yet instituted to positively determine the purity of a water supply. This is the standard adopted by law in Germany which obliges the filtration of all surface water supplies by a system of filtration so constructed as to remove all organisms in excess of 100 per cubic c. c. This analysis shows the water supplied to Lynn to be of greater purity than is called for by the most rigid test applied even to filtered water.

High Service.

The new high service supply has now been in successful operation for three years; sufficient pressure is given on the highest levels and a greater average pressure is secured over the entire high service than in the low.

Biological.

Weekly biological examinations have been made of the top and bottom water in all of the reservoirs and from a tap at the City Hall during the year. The purity of the supply is improving.

Street Mains.

During the last year cement-lined pipe has been replaced with cast-iron pipe in the following streets:

Albany, Baker, Congress, Chase, Hanover, Timson streets and Bruce's court.

Water Supply for Fire Purposes.

The city of Lynn is exceptionally well provided with a water supply for fire purposes. The water is delivered from the distributing reservoir on Pine Hill by three mains, 30-inch, 24-inch and 16-inch respectively to Walnut street at the pumping station. From the pumping station a 20-inch main extends through Walnut, Winter, Cedar, Mall and North Common streets, City Hall square, Central avenue to Andrew street, and through Liberty from Central avenue to Willow street. A 16-inch main

from the pumping station passes through Walnut, North Federal, Marion, Centre, Elm, Summer and Andrew streets, connecting at that point with a 20-inch main, then through Central avenue and Union street to Silsbee street.

A 12-inch pipe from the 30-inch main at the pumping station is laid through Walnut, Kirtland, Marion, Federal and North Common streets, connecting with the 20-inch main at Mall street. A 12-inch main from the reservoir for the high service runs down the Reservoir road to Linwood street, thence through Tapley street, Woodlawn street, Lover's Leap avenue, Forest, North Franklin and Franklin streets, Western avenue to Washington street where it is connected to the low service and can be used if necessary.

In the business part of the city 1,000,000 gallons per hour can be delivered if necessary.

Land Purchased in 1898.

Andrew Mansfield . . . . .	.69 acres
A. A. Mansfield . . . . .	.93 acres
A. A. Mansfield	1.23 acres
Mary A. Wilson	28.25 acres
Mary A. Wilson	8.31 acres
Mary A. Wilson	3.51 acres
F. H. Coburn	3.75 acres
B. S. Hone	4.88 acres
B. S. Hone	3.55 acres
M. Burns	10.64 acres

Statement.

WATER DEBT.

Amount of debt, Dec. 20, 1897 . . .	\$1,800,300 00	
Bonds issued in 1898	35,000 00	
Total Dec. 20, 1898		\$1,835,300 00

SINKING FUNDS.

Amount of funds Dec. 20, 1897 . . .	\$367,360 71	
Received from Treasurer, 1898 . . .	43,898 39	
Income from investments in 1898 . . .	14,882 16	
Total amount in hands of Commissioners, Dec. 20, 1898	\$426,141 26	
Balance in hands of Treasurer, Dec. 20, 1898	60,550 82	486,692 08

Treasurer's Statement for the Year Ending Dec. 20, 1898.

RECEIPTS.

From water rates	\$181,877 11	
From premiums on loans	4,388 75	
From accrued interest on bonds sold	84 44	
	<hr/>	\$186,350 30

EXPENDITURES.

For maintenance	\$50,953 24	
For interest	74,846 24	
	<hr/>	125,799 48
Net income		<hr/> \$60,550 82

Respectfully submitted,

W. B. LITTLEFIELD,

President.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
 Lynn, Mass., January 1, 1899. }

To Wm. B. Littlefield, President:

SIR,—I herewith present the financial condition of the department for the year ending December 31, 1898.

RECEIPTS FOR 1898.

Fixture rates	\$117,630 91	
Meter rates	57,139 78	
Additional rates	1,620 54	
Miscellaneous	5,315 87	
Fines	52 80	
Total revenue	<u> </u>	\$181,759 90
Extra pipe		2,842 44
Total receipts as per cash book		<u> </u> \$184,602 34

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$181,759 90
Amount outstanding, fixture rates	\$17,266 49
Amount outstanding, meter rates	5,793 36
Amount outstanding (not due) meter rates	13,227 51
	<u> </u> 36,287 36
	\$218,047 26
Deduct amount due January 1, 1898	31,388 91
Revenue for 1898	\$186,658 35
Revenue for 1897	183,711 97
Increase	<u> </u> \$2,946 38

STATEMENT OF NET EARNINGS FOR 1898.

Revenue		\$186,658 35
EXPENSES.		
Interest	\$74,846 24	
Maintenance	47,819 63	
Rebate to Saugus	3,348 33	
	<hr/>	126,014 20
Net earnings		\$60,644 15

EXPENDITURES FOR THE YEAR 1898.

MAINTENANCE.		
Pumping	\$10,338 41	
Salaries and office	8,619 20	
Services	6,245 09	
Mains	5,627 13	
Meters	4,586 98	
Engines and boilers	2,977 75	
Legal (tubular wells)	2,368 91	
Stable and shop	2,342 36	
Taxes, Saugus and Lynnfield	1,210 22	
Walden pond	947 81	
Conduit	544 50	
Lighting plant	510 00	
Hawkes' pond	345 48	
Engine house	296 03	
Damages	250 06	
Laboratory	192 30	
Reservoir	180 03	
Birch pond	118 62	
Glen Lewis pond	66 75	
Breed's pond	52 00	
	<hr/>	\$47,819 63
CONSTRUCTION.		
Hawkes' pond canal	\$17,637 51	
Hawkes' pond	9,611 35	
Services	4,290 39	
Mains	4,262 16	
Stand-pipe	62 00	
	<hr/>	\$35,863 41
Less amount received for pipe		2,842 44
Net		<hr/> \$33,020 97

STATEMENT.

SHOWING COST OF WORKS TO JANUARY 1, 1899.

Mains, hydrants and gates	\$847,507 52
New supply and land	337,390 75
Services and courts	293,678 50
Walden and Glen Lewis ponds	185,179 42
Engines and boilers	140,327 29
Reservoirs and land	131,581 49
Hawkes' pond	157,432 56
Birch pond and land	93,471 84
Engine house and land	57,562 39
Breed's pond and land	57,135 28
Pipe conduits and land	45,293 98
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,274 07
Hawkes' pond canal	40,803 68
Highland service	12,431 17
Tubular wells	9,470 02
Engineering	9,246 17
Work shop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,534,435 65
Less amount received for pipe	137,647 00
	<hr/>
Total net cost	\$2,396,788 65

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,456	
Number of services in Saugus	842	
Total	<u> </u>	12,298
Number put in during the year (Lynn)	82	
Number put in during the year (Saugus)	37	
Total	<u> </u>	119
Number extended during the year (Lynn)	19	
Number extended during the year (Saugus)	2	
Total	<u> </u>	21
Number discontinued	15	
Number not in use	24	
Turned on (new services)	114	
Turned on (reoccupied)	363	
Turned on (rates and fines paid)	8	
Shut off (for vacancy)	490	
Shut off (for non-payment)	31	
Shut off (for repairs)	30	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
 ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
 CONTAINED IN THE SAME, TOGETHER WITH THE
 NUMBER OF FIRE HYDRANTS, DEC. 31, 1898.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	11,450	807	12,257
Stores and shops	1,186	41	1,227
Factories	183	2	185
Offices	474	15	489
Restaurants and saloons	80	..	80
School-houses	52	7	59
Churches	29	5	34
Bakeries	32	..	32
Laundries	20	..	20
Engine houses	11	3	14
Families	15,930	903	16,833
Boarding-houses	225	2	227
Faucets	30,354	1,610	31,964
Water-closets	13,422	475	13,897
Bath tubs	5,301	307	5,608
Hose bibbs	3,057	140	3,197
Urinals	189	8	197
Heaters	854	51	905
Stationary engines	157	6	163
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	29	..	29
Stand-pipes for fire purposes	16	1	17
Stand-pipes for water-carts	72	..	72
Sewer connections	21	..	21
Automatic sprinklers	89	2	91
Hydrants	795	141	936
Hydrants for car sprinklers	36	..	36

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	.	.	.	\$8,989	00
From January 1, 1872, to January 1, 1873	.	.	.	27,568	15
From January 1, 1873, to January 1, 1874	.	.	.	47,992	61
From January 1, 1874, to January 1, 1875	.	.	.	53,545	61
From January 1, 1875, to January 1, 1876	.	.	.	52,553	26
From January 1, 1876, to January 1, 1877	.	.	.	60,807	12
From January 1, 1877, to January 1, 1878	.	.	.	64,002	50
From January 1, 1878, to January 1, 1879	.	.	.	67,570	14
From January 1, 1879, to January 1, 1880	.	.	.	73,949	80
From January 1, 1880, to January 1, 1881	.	.	.	79,635	12
From January 1, 1881, to January 1, 1882	.	.	.	80,967	76
From January 1, 1882, to January 1, 1883	.	.	.	94,419	52
From January 1, 1883, to January 1, 1884	.	.	.	98,393	54
From January 1, 1884, to January 1, 1885	.	.	.	114,903	86
From January 1, 1885, to January 1, 1886	.	.	.	110,089	11
From January 1, 1886, to January 1, 1887	.	.	.	116,375	70
From January 1, 1887, to January 1, 1888	.	.	.	123,507	73
From January 1, 1888, to January 1, 1889	.	.	.	134,480	27
From January 1, 1889, to January 1, 1890	.	.	.	141,865	53
From January 1, 1890, to January 1, 1891	.	.	.	154,788	27
From January 1, 1891, to January 1, 1892	.	.	.	171,744	85
From January 1, 1892, to January 1, 1893	.	.	.	188,979	88
From January 1, 1893, to January 1, 1894	.	.	.	177,803	56
From January 1, 1894, to January 1, 1895	.	.	.	176,655	50
From January 1, 1895, to January 1, 1896	.	.	.	185,572	88
From January 1, 1896, to January 1, 1897	.	.	.	190,531	33
From January 1, 1897, to January 1, 1898	.	.	.	183,711	97
From January 1, 1898, to January 1, 1899	.	.	.	186,658	35
				\$3,168,622	93

FUNDED WATER LOAN.

When Payable.	Rate. Per Cent.	Amount.
Jan. 1, 1899	5	\$50,000
Jan. 1, 1900	5	50,000
Apr. 1, 1900	4	10,000
Jan. 1, 1901	5	50,000
Mar. 1, 1903	4	8,000
May 1, 1904	3½	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3½	66,500
Dec. 1, 1905	3½	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3½	31,000
Mar. 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3½	6,000
Apr. 1, 1916	3½	2,000
May 1, 1916	3½	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3½	6,500
June 1, 1917	3½	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
July 1, 1925	4	165,000
July 1, 1926	4	50,000
Sept. 1, 1927	4	25,000
July 1, 1928		25,000
Oct. 1, 1928		10,000
Note (on demand)	4	100,000
		<hr/>
		1,835,300

REPORT OF SUPERINTENDENT.

To Wm. B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1898.

Water Supply.

On January 1, 1898, the ponds contained :

Breeds, 202,000,000 gallons; Birch, 205,000,000 gallons; Glen Lewis, 115,000,000 gallons; Walden, 177,000,000 gallons; Hawkes', 185,000,000 gallons; a total of 884,000,000 gallons; equal to 192 days' supply.

The supply for the year was taken from the various sources as follows :

Breeds, 578,020,091 gallons; Birch, 149,533,965 gallons; Hawkes' and Walden, 1,004,666,796 gallons; a total of 1,732,220,852 gallons; it being an increase of 37,962,466 gallons over the consumption during 1897.

The water continued of good character throughout the year in all of the ponds, excepting in the period from June to October, the water in Glen Lewis having growth of vegetable organisms.

It was not necessary, however, to use any water from that pond during the summer months.

On January 1, 1899, there was stored in all of the ponds, 1,375,000,000 gallons of water; equal to 299 days' supply; an increase during the year of 491,000,000 gallons or 107 days' supply.

Hawkes' Pond Canal.

The canal from Saugus river to Hawkes' pond is completed.

Canal.

The water was drawn out of the canal to allow an inspection of the tunnel which was found to remain in good condition; the sides and bottom of the canal were thoroughly cleaned and are in good condition.

Pumping Station.

A new boiler has been placed in the pumping station to replace the old ones that were removed in December, 1897. The new boiler is known as the "Belpaire boiler," and is of the fire-box type, and is set without brick-work, being covered with non-heat-conducting asbestos material, two inches thick. It is equal in capacity to the two old ones combined, and requires but little more room than one, leaving ample room for another boiler should it be needed at any time. During the test the boiler developed a duty of 12.04 lbs. of water evaporated from and at 212 degrees per pound of combustible, which shows a very high efficiency.

The pumping plant is in excellent repair, the engines having required no extensive repairs during the year.

A small upright engine and dynamo have been installed in the basement of the pumping station for lighting the buildings, which can be done more cheaply with our own boilers, than by the old method.

During the year 5,347 feet cement-lined pipe was taken up and replaced with cast-iron mains in the following streets: Albany, Baker, Congress, Chase, Hanover, Timson, and Bruce's court. Two thousand two hundred and thirty-two feet of cast-iron pipe has been laid in six streets as petitioned for by the abutters. One hundred and fifteen bursts came in the cement-lined pipes.

During the year 6 gates have been set in connection with the new mains; one has been set for street sprinkling; 2 new gates replaced old ones; one hydrant was put in for street sprinkling by cars; 3 street sprinklers were repaired; 39 hydrants were repaired; 39 leaks in hydrants and 12 leaks in main gates were repaired; 6 new hydrants replaced old ones; 35 main gate boxes

were raised where streets were graded; 249 feet of ledge was excavated in trenching for mains in new work and 169 feet in service trenches; 98 services were put in, aggregating 4,739 feet in length; 17 services were extended a length of 708 feet; 40 were discontinued; 41 services were renewed; 164 services were changed from the old pipe to the new; 22 service boxes were changed where streets were graded; 62 new gate boxes were put in; 787 corporations were cleaned out; 147 lead pieces were put in place of old ones; 89 iron stop boxes replaced old wooden ones; 176 stop boxes were reset; 204 leaks in service pipe were repaired; 497 services were cleaned out; 20 services were thawed out; 31 new stop and wastes were put in to replace old ones; 26 private hydrants were repaired; 244 meters were set; 152 meters were changed; 12 new meter boxes replaced old ones; 7 new outside meter boxes were put in.

The following tables show the work performed by the department during the year:

Respectfully presented,

JOHN C. HASKELL,

Superintendent.

ANALYSIS OF WATER IN BREED'S POND BY THE STATE BOARD OF HEALTH.
PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITRO-GEN AS							
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Albuminoid.		Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.	Hardness.	Iron.	
											Total.	In solution.							In suspension.
Jan. 11	Jan. 12	Very slight	Slight	0.40	Faintly vegetable	Distinctly vegetable	3.75	1.15	2.60	.0080	.0190	.0160	.0030	.64	.0050	.0001	.4800	1.4	..
Feb. 8	Feb. 9	Very slight	Slight	0.49	None	Faintly vegetable	3.80	1.45	2.35	.0050	.0176	.0154	.0022	.64	.0000	.0000	.6000	1.0	..
Mar. 8	Mar. 9	Very slight	Slight	0.60	Faintly musty	Faintly musty	3.25	1.25	2.00	.0018	.0132	.0116	.0016	.40	.0020	.0000	.5280	0.8	..
Apr. 12	Apr. 13	Very slight	Very slight	0.46	Distinctly vegetable	Distinctly vegetable	3.50	1.55	1.95	.0050	.0158	.0138	.0020	.45	.0030	.0004	.4520	0.5	..
May 10	May 11	Slight	Slight	0.50	None	Faintly oily	3.20	1.25	1.95	.0016	.0162	.0138	.0024	.50	.0000	.0001	.4640	0.5	..
June 7	June 8	Very slight	Very slight	0.59	Faintly vegetable	Distinctly vegetable	3.50	1.65	1.85	.0010	.0168	.0132	.0036	.50	.0000	.0001	.5280	0.8	..
July 12	July 13	Very slight	Slight	0.39	None	None	3.40	1.60	1.80	.0006	.0218	.0174	.0044	.43	.0000	.0000	.4800	0.5	..
Aug. 8	Aug. 10	Very slight	Very slight	0.30	None	None	2.90	1.50	1.40	.0002	.0192	.0174	.0018	.42	.0000	.0000	.4320	0.6	..
Sept. 13	Sept. 14	Very slight	Slight	0.42	None	Distinctly vegetable	3.30	1.50	1.80	.0010	.0360	.0336	.0034	.42	.0010	.0000	.5760	0.8	..
Oct 11	Oct. 12	Slight	Very slight	0.40	Faintly vegetable	Distinctly vegetable	3.55	1.70	1.85	.0000	.0202	.0178	.0024	.45	.0010	.0000	.51	0.6	..
Nov. 8	Nov. 9	Very slight	Very slight	0.45	Faintly vegetable	Distinctly vegetable	4.00	2.20	1.80	.0010	.0236	.0224	.0032	.50	.0010	.0002	.6400	0.8	..
Dec. 12	Dec. 14	Very slight	Very slight	0.50	Very faintly veg'ble	Faintly vegetable	3.65	1.65	2.00	.0014	.0180	.0172	.0008	.45	.0020	.0000	.6320	1.1	..

ANALYSIS OF WATER IN GLEN LEWIS POND BY THE STATE BOARD OF HEALTH.
PARTS IN 100,000.

DATE OF EXAMINATION.	APPEARANCE.	ODOR.	RESIDUE ON EVAPORATION.										IRON.				
			Color.		Cold.	Hot.	Loss on Ignition.		Fixed.	Free.	Total.	Albuminoid.		In suspension.	Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.	Hardness.
Turbidity.	Sediment.	Distinctly vegetable and grassy	Distinctly vegetable	3.70			1.90	1.80				0.04	0.314							0.074	0.040	0.57	0.130	0.001	5.000	0.8
Jan. 11 Jan.	12 Very slight	Very slight	0.40	Faintly vegetable	Distinctly vegetable and grassy	3.70	1.90	1.80	0.04	0.314	0.074	0.040	0.57	0.130	0.001	5.000	0.8
Feb. 8 Feb.	9 Very slight	Slight	0.30	Faintly vegetable	Distinctly vegetable	3.70	1.40	2.30	0.040	0.042	0.000	0.042	0.56	0.050	0.000	4.000	0.8
Mar. 8 Mar.	9 Slight	Con. earthy	0.22	Decidedly mouldy and fishy	Decidedly mouldy and unpleasant	2.75	1.00	1.75	0.000	0.018	0.006	0.012	0.34	0.050	0.000	2.500	0.5
Apr. 12 Apr.	13 Very slight	Slight	0.25	Distinctly vegetable	Distinctly vegetable and faintly fishy	2.75	1.15	1.60	0.000	0.002	0.018	0.014	0.28	0.010	0.000	2.000	0.5
May 10 May	11 Very slight	Con. organism	0.27	Distinctly only	Strongly only	3.00	1.10	1.90	0.010	0.044	0.004	0.058	0.41	0.000	0.000	3.500	0.5
June 7 June	8 Very slight	Con. Heavy organism	0.40	Faintly musty	Distinctly musty	3.15	1.50	1.65	0.000	0.044	0.066	0.075	0.30	0.010	0.000	4.000	0.2
July 12 July	13 Slight	Con. organism	0.60	None	Distinctly vegetable	3.40	1.30	2.10	0.015	0.040	0.080	0.010	0.58	0.000	0.000	5.100	0.5
Aug. 9 Aug.	10 Slight	Con. organism	0.50	Decidedly musty	Decidedly musty and vegetable	3.05	2.30	1.65	0.044	0.058	0.024	0.034	0.20	0.000	0.000	4.300	0.5
Sept. 13 Sept.	14 Decided	Con. organism	0.60	Faintly vegetable	Distinctly vegetable	4.55	2.00	2.55	0.010	0.010	0.079	0.038	0.20	0.010	0.000	4.200	0.5
Oct. 11 Oct.	12 Slight	Con. green alga	0.41	Faintly vegetable	Distinctly vegetable	4.70	2.05	2.65	0.010	0.062	0.050	0.040	0.20	0.010	0.000	4.400	0.5
Nov. 8 Nov.	9 Very slight	Con. green alga	0.41	None	Distinctly vegetable	4.05	2.25	1.80	0.010	0.060	0.054	0.010	0.27	0.000	0.000	5.000	0.3
Dec. 12 Dec.	14 Slight	Slight	0.50	Faintly vegetable	Distinctly fishy and only	1.55	1.35	2.55	0.000	0.004	0.006	0.005	0.19	0.010	0.000	4.000	0.5

ANALYSIS OF WATER IN WALDEN POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.				AMMONIA.			NITRO- GEN AS		Oxygen consumed.	Hardness.	Iron.
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Chlorine.				Nitrates.	Nitrites.
Jan. 11 Jan. 12	Slight			1.05	Faintly vegetable	Distinctly vegetable	4.60	2.40	.0016	.0034	.0288	.0046	.57	.0150	.0001	.8560	1.0
Feb. 8 Feb. 9	Slight			1.00	Faintly vegetable	Distinctly vegetable	4.50	2.50	.0044	.0968	.0284	.0014	.54	.0060	.0001	.8560	1.1
Mar. 8 Mar. 9	Slight			.61	Faintly vegetable	Distinctly vegetable	3.25	1.50	.0004	.0206	.0159	.0034	.32	.0030	.0000	.6480	0.8
Apr. 12 Apr. 13	Slight			0.48	Distinctly fishy	Strongly fishy and musty	2.90	1.50	.0018	.0272	.0199	.0080	.32	.0020	.0001	.4880	0.5
May 10 May 11	Very slight			0.49	None	Distinctly fishy	3.35	1.55	.0000	.0240	.0184	.0056	.40	.0000	.0000	.4920	0.5
June 7 June 8	Slight			0.60	Faintly vegetable	Distinctly vegetable	3.45	1.55	.0012	.0250	.0208	.0042	.40	.0040	.0001	.5280	0.3
July 12 July 13	Slight			0.57	None	Distinctly vegetable	3.00	1.75	.0010	.0346	.0262	.0084	.40	.0010	.0000	.5760	0.5
Aug. 9 Aug. 10	Very slight			0.42	Faintly vegetable	Distinctly vegetable	3.35	1.50	.0002	.0242	.0204	.0038	.39	.0000	.0000	.5040	0.5
Sept. 13 Sept. 14	Decided			0.67	None	Faintly vegetable	3.25	1.75	.0004	.0450	.0380	.0070	.35	.0020	.0000	.7360	0.5
Oct. 11 Oct. 12	Decided			0.46	None	Distinctly vegetable	3.95	2.50	.0000	.0174	.0314	.0060	.33	.0000	.0000	.67	0.8
Nov. 8 Nov. 9	Very slight			0.63	Faintly vegetable	Distinctly vegetable	3.60	1.40	.0002	.0292	.0262	.0030	.34	.0020	.0000	.7120	0.3
Dec. 12 Dec. 14	Slight			0.60	None	Very faintly veg'ble	3.70	2.00	.0008	.0244	.0268	.0024	.35	.0020	.0000	.8080	0.6

ANALYSIS OF WATER IN HOWLETT'S POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	APPEARANCE.	ODOR.	RESIDUE ON EVAPORATION.	AMMONIA.				NITROGEN AS									
				Albuminoid.				Chlorine.									
				Total.	Free.	Fixed.	Loss on ignition.	In solution.	In suspension.	Nitrates.	Nitrates.						
	Turbidity.	Sediment.	Color.	Hot.	Cold.									Oxygen consumed.	Hardness.	Iron.	
Jan. 11 Jan.	12 Slight		1.20	Faintly vegetable		Distinctly vegetable	0.40	0.50	0.06	0.32	0.04	1.11	0.25	0.003	0.44	3.1	
Feb. 5 Feb.	9 Very slight	0.03	Faintly vegetable			Distinctly vegetable	0.25	0.50	0.15	0.18	0.04	0.20	0.06	1.10	0.30	0.003	0.50
Mar. 5 Mar.	9 Slight		0.70	Faintly musty		Distinctly musty	0.20	0.50	0.30	0.04	0.04	0.04	0.04	0.04	0.04	0.23	
Apr. 12 Apr.	13 Very slight	0.88	Distinctly vegetable and musty			Strongly vegetable and musty	0.50	0.25	0.85	0.00	0.30	0.07	0.00	0.74	0.10	0.004	0.20
May 10 May	11 Very slight	1.00	Distinctly vegetable			Distinctly vegetable	0.45	0.15	4.10	0.10	0.04	0.24	0.10	0.81	0.00	0.004	0.80
June 7 June	8 Very slight	1.40	Distinctly vegetable			Distinctly vegetable and musty	0.45	0.15	3.50	0.02	0.30	0.14	0.01	0.67	0.00	0.002	1.00
July 12 July	13 Decided	0.04	Distinctly vegetable			Strongly vegetable	0.30	0.45	0.85	0.00	0.05	0.02	1.03	0.10	0.00	0.00	0.90
Aug. 9 Aug.	10 Very slight	Slight	0.94	Distinctly musty		Distinctly musty	0.05	0.30	0.65	0.04	0.17	0.04	0.04	0.60	0.10	0.00	1.00
Sept. 13 Sept.	14 Very slight	Very slight	0.70	Distinctly vegetable		Distinctly vegetable and musty	0.40	0.35	4.55	0.01	0.82	0.06	0.06	0.88	0.00	0.001	1.06
Oct. 11 Oct.	12 Very slight	Slight	0.96	Faintly vegetable		Distinctly vegetable	0.20	0.40	3.50	0.01	0.32	0.04	0.04	0.70	0.10	0.00	1.22
Nov. 5 Nov.	9 Very slight	Very slight	0.95	Faintly vegetable		Distinctly vegetable	0.20	0.45	0.00	0.00	0.00	0.00	0.00	0.70	0.10	0.00	0.80
Dec. 12 Dec.	14 Very slight	Slight	0.94	None		Faintly vegetable	0.20	0.45	0.15	0.04	0.04	0.00	0.00	0.95	0.10	0.00	0.80

ANALYSIS OF WATER IN HAWKES POND BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITRO- GEN AS		Iron.				
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Free.	Total.	In solution.	In suspension.	Chlorine.		Nitrates.	Nitrites.	Oxygen consumed.	Hardness.
Jan. 11	Jan. 12	Slight	Very slight	0.90	Faintly vegetable	Distinctly vegetable	5.80	2.30	3.50	.0024	.0066	.0028	.0038	.63	.0010	.0001	.8080	1.8
Feb. 8	Feb. 9	Slight	Slight	0.62	Faintly vegetable	Distinctly vegetable	4.05	1.60	2.45	.0066	.0180	.0160	.0018	.44	.0060	.0001	.6240	1.0
Mar. 8	Mar. 9	Slight	Slig't earthy	0.60	Faintly vegetable and musty	Faintly vegetable and musty	3.65	1.80	1.85	.0014	.0152	.0142	.0010	.34	.0060	.0001	.5200	1.1
Apr. 12	Apr. 13	Very slight	Very slight	0.45	Distinctly vegetable	Distinctly vegetable	4.00	1.85	2.15	.0006	.0198	.0174	.0024	.44	.0090	.0001	.5160	1.3
May 10	May 11	Very slight	Slight	0.62	Faintly vegetable	Distinctly vegetable and fishy	3.50	1.40	2.10	.0004	.0198	.0156	.0042	.47	.0040	.0002	.5520	1.3
June 7	June 8	Very slight	Slight	0.70	Faintly vegetable	Distinctly vegetable and fishy	4.00	1.65	2.35	.0012	.0282	.0180	.0096	.43	.0000	.0003	.6560	1.1
July 12	July 13	Slight	Slight	0.39	Distinctly musty	Distinctly musty	3.85	1.95	1.90	.0008	.0062	.0236	.0026	.44	.0010	.0000	.5120	1.0
Aug. 9	Aug. 10	Slight	Slight	0.28	Faintly vegetable	Faintly vegetable	3.60	1.70	1.90	.0018	.0218	.0180	.0032	.38	.0000	.0000	.4480	1.0
Sept. 13	Sept. 14	Slight	Very slight	0.20	None	Faintly vegetable	3.50	1.60	1.90	.0006	.0272	.0240	.0032	.35	.0000	.0000	.5280	1.0
Oct. 11	Oct. 12	Slight	Cons.	0.34	None	Faintly vegetable	3.75	2.00	1.75	.0004	.0068	.0218	.0050	.40	.0000	.0001	.59	1.7
Nov. 8	Nov. 9	Very slight	Slight, some sand	0.41	Faintly vegetable	Distinctly vegetable	4.05	1.65	2.40	.0006	.0222	.0154	.0008	.44	.0020	.0000	.4960	0.8
Dec. 12	Dec. 14	Very slight	Slight, also scum	0.47	Very faintly veg'ble	Distinctly fishy and oily	4.55	2.10	2.45	.0022	.0212	.0192	.0020	.41	.0040	.0000	.5520	1.4

ANALYSIS OF WATER IN SAUCUS RIVER BY THE STATE BOARD OF HEALTH.

PARTS IN 100,000.

DATE OF Collection.	APPEARANCE.	ODOR.	RESIDUE ON EVAPORATION.	AMMONIA.		Total.	Fixed.	Loss on ignition.	Total.	Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.	Hardness.	Iron.
				Albuminoid.											
				Turbidity.	Sediment.											Cold.	Hot.	In solution.	In suspension.
Jan. 11	Very slight Cons.		1.06	Faintly vegetable	Distinctly vegetable and faintly musty	9.75	3.60	5.15	.0016	.0134	.0000	.50	.0080	.0001	1.0000
Feb. 8	Very slight Slight		1.00	Faintly vegetable	Distinctly vegetable	7.40	2.55	4.85	.0000	.0072	.0000	.00	.0030	.0000	.0000
Mar. 5	Very slight Cons. earthy		.70	Faintly vegetable	Distinctly vegetable	5.75	2.30	3.45	.0014	.0050	.0032	.0018	.70	.0000	.0001
May 10	Very slight Very slight	1.12	Distinctly vegetable	Distinctly vegetable	6.15	2.35	3.50	.0000	.0050	.0000	.00	.0000	.0000	.0000	.0000
June 7	None Slight		1.70	Distinctly vegetable	Distinctly vegetable	6.25	1.30	4.95	.0000	.0050	.0130	.0000	.00	.0000	.0000
July 12	Very slight Very slight	0.70	Faintly musty	Distinctly musty	6.05	3.35	2.70	.0000	.0032	.0000	.0018	.00	.0000	.0000	.0000
Aug. 9	Very slight Very slight	1.45	Faintly vegetable	Distinctly vegetable	9.40	4.65	4.75	.0034	.0000	.0050	.0000	.53	.0000	.0001	.0000
Oct. 11	Slight Cons.		.40	Faintly vegetable	Distinctly vegetable	7.70	1.85	5.85	.0034	.0000	.0000	.0000	.65	.0000	.0001
Nov. 5	Very slight Cons.		.45	Faintly vegetable	Faintly vegetable and disagreeable	7.30	1.05	4.15	.0000	.0000	.0000	.0000	.63	.0000	.0001
Dec. 12	Very slight Slight		0.68	Very faintly vegetable	Faintly vegetable and disagreeable	7.30	1.04	4.00	.0000	.0000	.0000	.0000	.70	.0000	.0001

ANALYSIS OF WATER IN THE TAP BY THE STATE BOARD OF HEALTH.
PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITRO-GEN AS		Hardness.	Iron.		
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Free.	Total.	In solution.	In suspension.			Chlorine.	Nitrates.	Nitrites.	Oxygen consumed.
Jan. 11 Jan. 12	Very slight	Slight		0.50	Faintly vegetable	Faintly vegetable	4.25 1.65	2.60	.0008	.0176	.0172	.0004	.08	.0150	.0000	4240 1.6
Feb. 8 Feb. 9	Slight	Very slight		0.69	Faintly vegetable	Distinctly vegetable	4.90 1.80	3.10	.0036	.0198	.0186	.0012	.54	.0100	.0002	6720 1.4
Mar. 8 Mar. 9	Very slight	Very slight		0.54	Faintly musty	Faintly musty	3.75 1.60	2.15	.0006	.0154	.0140	.0014	.47	.0030	.0000	4880 1.0
Apr. 12 Apr. 13	Very slight	Very slight		0.41	Distinctly vegetable	Distinctly vegetable	3.40 1.40	2.00	.0006	.0150	.0136	.0014	.38	.0030	.0000	4400 0.8
May 10 May 11	Very slight	Cons.		0.41	Faintly vegetable	Faintly vegetable	3.45 1.25	2.20	.0004	.0138	.0136	.0012	.50	.0030	.0000	4400 0.8
June 7 June 8	Very slight	Cons. iron		0.52	None	Faintly musty	3.40 1.60	1.80	.0006	.0182	.0132	.0050	.44	.0010	.0001	4800 1.0
July 12 July 13	Slight	Slight		0.47	None	None	3.45 1.40	2.05	.0002	.0204	.0192	.0012	.40	.0030	.0000	4720 0.8
Aug. 8 Aug. 10	Very slight	Slight		0.32	None	None	3.60 1.65	1.95	.0008	.0164	.0152	.0012	.36	.0050	.0001	3680 1.0
Sept. 13 Sept. 14	Very slight	Very slight		0.37	None	Faintly vegetable	3.75 1.75	2.00	.0004	.0178	.0164	.0014	.38	.0030	.0000	4640 1.0
Oct. 11 Oct. 12	Slight, milky	Cons.		0.39	None	F. veg. disagree'ble	3.80 1.50	2.30	.0002	.0184	.0180	.0004	.44	.0020	.0000	0.36 1.6
Nov. 8 Nov. 9	Very slight	Very slight		0.35	None	Faintly vegetable	3.75 1.50	2.25	.0002	.0170	.0162	.0008	.44	.0010	.0000	4480 1.1
Dec. 12 Dec. 14	Very slight	Very slight		0.45	None	Very faintly veg'ble	3.50 1.45	2.05	.0006	.0176	.0168	.0008	.44	.0020	.0001	5380 0.5

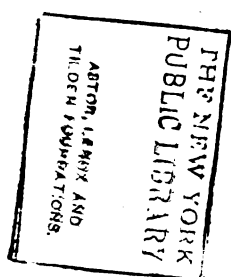
ANALYSIS OF WATER IN SAUGUS RIVER AT MONTROSE BY THE STATE BOARD OF HEALTH.
PARTS IN 100,000.

DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITRO-GEN AS		Oxygen consumed.	Hardness.	Iron.			
Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Total.	In solution.				In suspension.	Chlorine.	Nitrates.	Nitrites.
July 7	8	None	Very slight	1.50	Faintly vegetable	Distinctly vegetable	6.90	3.15	3.75	.0010	.0380	.0314	.0006	.85	.0010	.0002	1.2320	2.7
Aug. 12	14	Very slight	Very slight	0.68	Faintly musty	Distinctly musty	8.20	3.35	4.85	.0032	.0336	.0326	.0010	.76	.0010	.0000	.8880	3.6
Sept. 9	10	Very slight	Slight	1.40	Faintly vegetable	Distinctly vegetable	9.55	4.90	4.65	.0034	.0536	.0458	.0078	.52	.0020	.0001	1.6960	3.5
Oct. 13	14	Very slight	Slight	.66	None.	Faintly vegetable	8.40	3.90	4.50	.0140	.0380	.0346	.0040	.70	.0030	.0001	.6440	3.1
Nov. 11	12	Very slight	Cons. Earthy	.87	Faintly vegetable	Distinctly vegetable	7.30	3.25	4.05	.0076	.0500	.0322	.0178	.63	.0000	.0000	1.06	2.7
Dec. 8	9	Very slight	Cons. Earthy	.85	Faintly vegetable	Distinctly vegetable and disagreeable	6.60	3.25	3.35	.0032	.0392	.0302	.0090	.55	.0020	.0000	0.9920	2.9

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1898

MONTH.	GALLONS.				
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.
January	140,153,558	4,521,082			63.05
February	130,506,550	4,660,948	130,866		65.92
March	140,853,173	4,543,651		117,297	64.27
April	127,619,680	4,254,000		289,651	60.17
May	138,500,085	4,477,745	215,745		63.19
June	144,000,145	4,900,005	332,260		67.89
July	156,000,735	5,034,217	234,212		71.06
August	150,208,117	4,845,423			68.53
September	150,515,607	5,127,207	481,784		75.37
October	150,422,043	5,045,872		281,425	71.37
November	142,570,352	4,752,345		293,527	67.22
December	145,507,207	4,791,721		52,574	69.39
Totals and averages	1,732,221,552	4,745,810			67.13



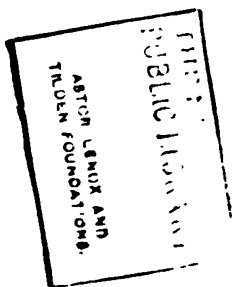


TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1898.

MONTH.	GALLONS.			
	Breed's.	Birch.	Canal.	Total.
January	14,282,410	47,222,250	75,149,540	136,654,200
February	78,869,650	. . . . .	52,262,450	131,132,100
March	99,032,820	. . . . .	43,024,980	142,057,800
April	37,262,375	. . . . .	90,931,025	128,193,400
May	58,578,105	. . . . .	78,396,045	136,974,150
June	46,428,300	. . . . .	99,291,150	145,719,450
July	21,159,578	. . . . .	134,578,877	155,738,455
August	24,173,338	. . . . .	122,886,197	147,059,535
September	49,218,975	. . . . .	114,844,275	164,063,250
October	18,297,190	102,311,715	31,568,795	152,177,700
November	39,503,160	. . . . .	103,941,090	143,444,250
December	91,214,190	. . . . .	57,147,810	148,362,000
Totals	578,020,091	149,533,965	1,004,022,234	1,731,576,290

Largest day, July 8, 7,983,100 gallons.

Largest week, October 15, 37,493,400 gallons.

TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1898.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	*0.15	..	..	..	0.05	..	..	..	..	..	..
2	..	..	*0.08	0.17	..	0.04	..	..	0.44	..	..	..
3	..	..	..	..	0.11	0.42	..	0.32	..	..	..	..
4	*0.20	..	*0.42	*0.02	..	0.15	0.92	0.35	..	1.37	..	0.62
5	..	0.20	..	*0.39	0.30	..	..	0.58	..	0.72	0.07	..
6	0.18	..	..	..	..	..	..	..	..	0.20	0.20	..
7	..	..	..	..	..	0.02	..	0.02	0.46	0.20	..	..
8	..	..	..	..	..	..	0.16	1.58	..	0.03	..	..
9	..	..	..	..	..	..	..	..	..	..	0.05	..
10	..	..	..	0.08	..	..	..	2.42	..	..	1.19	..
11	..	..	..	..	..	..	..	0.06	..	0.77	..	..
12	0.05	0.15	0.15	..	..	..	0.15	0.23	..	0.02	..	*0.30
13	..	..	..	0.02	..	0.21	1.72	..	..	..	..	..
14	..	..	..	0.12	0.03	..	..	..	..	0.45	0.15	..
15	*0.30	0.10	..	1.11	0.32	..	..	..	..	0.05	..	..
16	..	*0.05	..	..	0.08	..	..	..	0.04	..	..	..
17	..	..	0.07	..	0.02	..	..	0.20	..	..	0.21	..
18	..	..	0.02	..	..	0.05	0.54	0.40	0.26	..	0.36	..
19	*0.17	..	0.45	0.55	..	0.30	..	1.70	..	0.64	1.01	*0.30
20	1.13	1.52	..	0.02	..	0.16	..	..	..	..	..	0.22
21	..	1.52	..	..	..	..	0.26	..	..	0.79	..	..
22	1.00	0.08	0.06	0.08	..	..	..	..	0.45	0.40	..	0.55
23	0.30	0.14	..	0.89	0.07	0.02	0.04	0.22	0.24	..	..	..
24	..	..	..	1.42	0.93	..	..	0.07	0.12	..	0.24	..
25	*0.75	..	..	0.09	0.94	0.06	..	0.10	..	..	..	..
26	*0.07	..	..	..	1.32	..	0.51	..	0.40	1.61	*0.74	..
27	..	..	..	..	0.08	..	..	..	..	..	*0.49	..
28	..	..	..	0.82	..	0.05	0.21	..	..	..	..	..
29	..	..	0.32	0.38	..	..	..	..	..	0.12	..	*0.01
30	..	..	0.34	..	..	..	0.20	..	..	0.02	*0.25	0.02
31	*1.72	..	0.10	..	0.02	..	..	..	..	..	..	*0.81
Total	5.87	3.91	2.01	6.15	4.22	1.53	4.71	8.25	2.41	7.19	5.09	2.86

* Snow.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1898.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	*0.02	..	..	..	..	..	..	..	..	..	..
2	..	..	*0.09	*0.14	..	0.09	..	..	0.44	..	..	..
3	..	..	*0.01	..	0.13	0.47	..	0.39	..	1.22	..	..
4	*0.19	..	0.30	..	..	0.13	0.91	0.13	..	0.81	0.30	0.53
5	..	..	..	*0.28	0.30	..	..	0.56	..	..	0.10	..
6	0.17	..	..	..	..	..	..	..	0.42	..	..	..
7	..	..	..	..	..	..	0.22	1.40	..	0.01	..	..
8	..	..	..	..	..	..	..	..	..	..	0.01	..
9	..	..	..	..	..	..	..	2.75	..	0.67	1.44	..
10	..	..	..	0.06	..	..	..	0.05	..	0.01	..	..
11	..	..	..	..	..	..	0.17	0.27	..	0.01	..	*0.29
12	0.07	0.16	0.14	..	..	0.23	1.86	..	..	..	0.19	..
13	..	..	..	..	..	..	..	..	..	0.47	..	..
14	..	..	..	0.13	0.01	..	..	..	..	0.06	..	..
15	..	0.12	..	1.11	0.30	..	..	..	..	..	..	..
16	..	..	..	0.03	0.08	..	..	..	0.03	..	..	..
17	..	..	..	0.01	0.02	..	..	0.13	0.20	..	0.24	..
18	..	..	..	..	..	..	0.43	0.29	..	0.41	..	..
19	*0.15	..	0.40	0.53	..	0.23	0.01	1.33	..	0.75	1.16	*0.27
20	0.94	1.49	..	..	..	0.16	..	..	..	0.01	..	0.16
21	..	1.74	..	..	..	..	0.50	..	..	1.00	..	..
22	*0.77	0.04	0.05	0.10	..	..	..	..	0.44	0.45	..	0.16
23	0.27	*0.10	..	0.78	0.05	..	..	0.22	0.33	..	..	..
24	..	..	..	1.58	0.92	..	0.06	0.05	0.09	..	0.35	..
25	*0.55	..	..	0.09	0.81	0.05	..	0.08	..	..	..	..
26	*0.02	..	..	0.02	1.42	..	0.50	0.01	0.20	1.62	*0.27	..
27	..	..	..	..	0.06	..	..	..	..	..	*0.06	..
28	..	..	..	0.80	..	0.09	0.22	..	..	..	..	..
29	..	..	0.32	0.40	..	..	..	..	..	0.16	*0.01	..
30	..	..	*0.32	..	..	..	0.19	..	..	0.03	0.25	..
31	*0.83	..	*0.01	..	0.03	..	..	..	..	..	..	*0.50
Total	4.25	3.67	1.64	6.11	4.13	1.45	5.07	7.53	2.15	7.25	4.69	2.42

* Snow.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1898.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Lewis Pond.
January 1	16.	19.9	16.	11.	16.6
January 8	16.1 ¹ / ₂	19.9	15.10	11.	17.
January 15	16.8	19.11	14.7	11.	17.2
January 22	17.4	20.	14.4	11.1	17.2 ¹ / ₂
January 29	19.7	21.	15.3	12.3	17.3
February 5	20.2	21.4	15.8	12.7 ¹ / ₂	17.3
February 12	20.3	21.	16.	12.9	17.3
February 19	20.8	20.7	16.2	12.11 ¹ / ₂	16.9
February 26	25.3	21.7 ¹ / ₂	18.	16.6 ¹ / ₂	14.4
March 5	25.2 ¹ / ₂	21.6	18.4	16.9 ¹ / ₂	15.5
March 8	25.2	20.9	18.9	17.2	16.2
March 14	25.2	21.	19.2	17.3	17.3
March 21	25.1	21.4	19.2 ¹ / ₂	17.3 ¹ / ₂	17.6
March 28	25.	20.4	19.4	17.4	17.7
April 4	24.11 ¹ / ₂	20.	19.5	17.4	17.7 ¹ / ₂
April 9	24.11	20.1 ¹ / ₂	19.6	17.2	17.7
April 16	25.1 ¹ / ₂	20.4	19.9	17.3	17.7 ¹ / ₂
April 23	24.10	20.8	20.	17.4	17.9
April 30	25.2	21.7	20.11 ¹ / ₂	17.4 ¹ / ₂	17.10
May 7	25.1	21.4 ¹ / ₂	21.2	17.2	17.8
May 16	25.1 ¹ / ₂	21.7 ¹ / ₂	21.3	17.	17.7
May 23	25.1	20.9	21.4	17.	16.8
May 31	25.2	21.8 ¹ / ₂	21.11 ¹ / ₂	17.3	17.4
June 4	25.1 ¹ / ₂	21.6	22.	17.2 ¹ / ₂	17.5
June 13	25.	21.2 ¹ / ₂	22.1 ¹ / ₂	16.10	16.10
June 20	25.	20.10	22.	16.4	16.1 ¹ / ₂
June 27	24.6	20.4	21.9	15.8	16.2
July 4	24.4	19.10	21.7	14.11	16.3
July 12	24.	19.3	21.4	14.1	16.2
July 18	23.11	19.3	21.4	13.6	16.4
July 25	24.	19.3	21.3	12.4	16.5
August 1	23.11	19.3	21.2 ¹ / ₂	11.8	16.4
August 9	24.2	19.4	21.3	10.10	16.6
August 15	24.8	19.9	21.6	10.6	17.1
August 22	24.5	19.7	21.6	10.6	17.4
August 29	24.1	19.5	21.6	10.5	17.6
September 5	22.9 ¹ / ₂	19.	21.4	10.4	17.7
September 12	21.11	18.7	21.3	10.3 ¹ / ₂	17.6 ¹ / ₂
September 19	20.9	17.6 ¹ / ₂	21.1	10.3	17.6
September 26	19.7	17.6	21.	10.2	17.7
October 3	18.4 ¹ / ₂	17.6	20.11	10.1	17.6
October 8	18.8	17.1	20.7	10.3	17.10
October 15	19.4	17.1	19.5	10.5 ¹ / ₂	18.
October 22	20.3	17.7	18.9	10.11	18.4
October 29	21.5	18.6	18.10	12.2	18.8
November 5	21.5 ¹ / ₂	18.8	18.11	12.9	18.6 ¹ / ₂
November 12	21.6	19.	19.2	13.5	18.6
November 19	21.6 ¹ / ₂	20.	19.5 ¹ / ₂	14.1 ¹ / ₂	18.6
November 26	22.1	20.5	20.	15.5	18.7
December 3	22.6	21.	20.6	16.2	18.7
December 10	23.	21.7	20.10	16.9	18.7
December 17	23.2 ¹ / ₂	21.1	21.	17.2	18.7
December 26	23.7	10.6	21.4	17.3	18.7
January 2	23.10 ¹ / ₂	19.4	21.5	17.4	18.7

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1898.

STREET.	LOCATION.
Bassett	On north line Ocean street, 17 feet west of east line of Bassett street.
Bruce's court....	On east line Fayette street, 8 feet south of north line of Bruce's court.
Chase.....	On north line Hanover street, 16 feet east of west line of Chase street.
Cliff	23 feet south of north line of Walnut street, 13 feet west of east line of Cliff street.
Jefferson	162 feet east of east line of Duke street, north of south line of Jefferson street.
Western avenue .	162 east line of Ida street, 24 feet south of north line of Western avenue.

HYDRANTS.

SHOWING THE LOCATION OF HYDRANTS SET IN 1898.

STREET.	LOCATION.
Gertrude	525 feet north west of Florence street.
Bruce's court....	End of court.

TABLE VII.

LEAKS IN PIPES AND HYDRANTS.

MONTH.	SIZE OF MAINS.						Hydrants.
	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	
January . . . . .	...	...	2	1	3	2	...
February . . . . .	...	...	1	...	...	3	...
March	1	...	...	...	4	1	...
April	1	...	...	...	4	3	1
May . . . . .	...	...	2	...	6	5	...
June . . . . .	...	1	...	...	3	3	5
July . . . . .	...	...	...	...	4	6	4
August . . . . .	...	...	...	3	4	1	8
September . . . . .	...	1	...	1	3	3	1
October . . . . .	...	...	...	...	3	11	9
November	1	...	1	...	11	10	6
December . . . . .	...	...	...	2	2	1	5
Totals	3	2	6	7	47	50	39

Total leaks, 115.

TABLE VIII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE IN 1898.

	$\frac{1}{2}$ in.	$\frac{3}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{2}$ in.	2 in.	3 in.	4 in.	Total
Trident	284	454	38	6	4	...	...	...	786
Thomson Bee	96	264	38	4	1	...	...	...	403
Thomson	83	118	55	12	2	1	1	...	272
Hersey	76	64	2	1	1	...	...	...	144
Ball and Fitts	36	36	17	...	...	...	...	...	89
Union . . . . .	...	26	13	8	8	...	14	...	69
Nash	54	13	1	...	1	...	...	...	69
Niagara	34	33	1	...	...	...	...	...	68
Lambert	36	13	2	...	1	...	...	...	52
Columbia	36	4	...	...	...	...	...	...	40
Worthington	3	8	11	1	7	1	...	...	31
Weir	1	...	3	4	10	2	...	...	20
Crown	1	1	6	6	2	...	...	...	16
Neptune . . . . .	...	9	3	...	...	...	...	...	12
Empire . . . . .	...	...	...	...	...	3	...	...	3
Motors	2	...	...	...	...	...	...	...	...
Totals	2	748	1,045	188	44	30	2	15	2,074

Total gallons metered, 260,000,000.

TABLE IX.

SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICES LAID IN 1898.

MONTH.	SIZE AND LENGTH OF PIPE.																TOTAL.	
	6 in.		4 in.		2 in.		1½ in.		1¼ in.		1 in.		¾ in.		½ in.			
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.		
March	2	29.	4	395.10	1	36.	7	370.10	
April	1	43.6	..	2	68.4	12	497.5	15	609.3	
May	1	36.8	2	156.6	3	360.7	3	208.3	9	762.	
June	1	51.6	3	121.11	2	107.11	1	12.6	7	293.10	
July	1	3.	..	..	1	28.	2	133.10	3	119.5	8	195.11	..	..	15	480.2
August . . . . .	..	..	..	..	..	..	..	..	3	190.	..	..	..	..	3	190.
September	1	28.	3	200.6	4	117.11	8	346.5	
October . . . . .	..	..	..	..	1	51.9	..	67.5	7	315.9	9	423.5	..	..	18	858.4
November . . . . .	..	..	..	..	..	..	..	..	8	559.	2	112.7	1	24.3	11	695.10
December	1	53.8	..	..	..	..	..	..	3	49.1	1	29.6	..	..	5	132.3
Totals	2	56.8	1	36.8	2	79.9	1	43.6	9	466.3	39	2,200.5	41	1,692.11	3	723		
																98	4,738.11	

Lynn—17 extensions, 707 ft. 6 in.; 23 renewals. Saugus—37 services, 1,565 ft. 11 in.; 2 extensions, 63 ft. 6 in.

41

198.

4 in.

*370

*75

*492

...

*593

*415

...

...

...

70

...

...

...

2,015

DET.

579

347

232

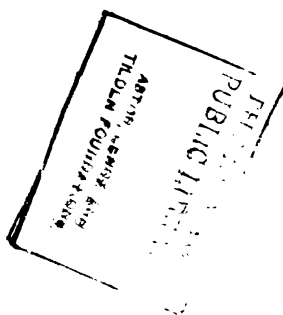
471

788

800

951

TABLE IX.



ASTORIA, OREGON AND
TIDAL FISHING

TABLE X.

SHOWING THE AMOUNT AND SIZE OF CAST-IRON PIPE LAID IN 1898.

WHERE LAID.	6 in.	4 in.
Albany street . . . . .	...	*370
Baker street	*1,286	*75
Bruce's court . . . . .	...	*492
Cliff street	529	...
Congress street . . . . .	...	*593
Chase street . . . . .	...	*415
Harmon street	350	...
Hanover street	*842	...
Henry place	140	...
Gertrude street . . . . .	...	70
Timson street	*1,274	...
Tracey avenue	855	...
Western avenue	288	...
Totals	5,564	2,015

*Relaid.

5,347 feet relaid; 2,232 feet new.

	MILES.	FEET.
Total pipe laid in 1898		7,579
Total cement pipe taken up and replaced with cast-iron pipe . .		5,347
Total extension		2,232
Previously laid	11.9	3,473
Private pipe in Swampscott		1,788
Pipe in Saugus	17	1,881
Total supplied by the works	12.7	6,051

SUMMARY OF STATISTICS.

Report of 1898.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1895.

Lynn and Saugus,

66,861

Date of construction,

1870 to 1898

Owned by

City of Lynn

Source of supply,

Five artificial storage basins formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co. of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 11,500,000 daily capacity, one Loretz high service engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek

2. Cost of Coal,

\$3.25 (2,000 lbs.) delivered.
Leavitt and High. Loretz.

3. Coal consumed for the year, in pounds,

235,900 2,517,160

4. Pounds of wood consumed in pounds coal,

	Leavitt and High.	Loretz.
5. Total consumed for the year (3)+(4),	235,900	2,518,470
6. Total pumpage for the year, in gallons,	133,450,140	1,598,126,150
7. Average dynamic head against which pump works,	167.52	164.22
8. a. Number of gallons pumped per pound of coal (3)+(4),	565 70	634.80
b. Number of gallons raised 100 feet per pound of coal (3)+(4),	947.66	1,042.47
9. Duty, in foot pounds per 100 pounds of coal, no deductions.		
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed.}}$	79,035.79†	86,954.554

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$10,472.41.

10. Per million gallons raised against dynamic head (7) into reservoir,	\$6 04
11. Per million gallons raised one foot high (dynamic),	3.67 cents.

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ. :
\$125,799.48.

12. Per million gallons raised against dynamic head (7) into reservoir,	\$72.65
13. Per million gallons raised one foot high (dynamic)	44.28 cents.

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
<i>From Consumers :</i>			
A. Water rates, domestic,	\$119,251.45	AA. Management and repairs,	\$50,953.24
B. Water rates, manufacturing,	57,139.78	BB. Interest on bonds,	74,846.24
C. Net receipts, for	\$176,391.23	CC. Total maintenance,	\$125,799.48
D. Repairs and sundries,	9,959.07	DD. Balance carried to sinking fund,	60,550.82
E. Gross receipts from all sources,	\$186,350.30	EE. Total,	\$186,350.30

CONSTRUCTION.

RECEIPTS.	EXPENDITURES.
F. From balance of 1897.	\$11,277.06
G. Pipes, meters and labor,	\$4,262.16
H. Loans,	4,290.39
	62.00
	17,637.51
	9,611.35
	35,863.41
	13,415.84
I. Total,	49,279.25

J. Bonded debt, Dec. 31, 1898, \$1,835,300.00.
 K. Value of sinking fund, \$486,692.08
 L. Rate of interest, 3½, 4, 4½, 5.

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	70,700
Estimated population supplied,	68,000
Total number of gallons consumed for the year,	1,732,220,852
No. of gallons metered,	260,000,000
Average daily consumption in gallons,	4,745,810
Gallons per day to each consumer.	69 79

DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron.
Size,	From 2 to 20 inches diameter.
Extended,	2,232 feet.
Total now in use,	109 miles, 3,411 feet.
Total now in use,	Lynn, Saugus Swampscott, 127 miles, 3,951 feet.
Number of leaks for the year,	115
Hydrants added,	1
Hydrants now in use,	794
Gates added,	6
Gates now in use,	948
Range of pressure of city for day and night,	50 to 65 pounds.

SERVICES.

Kind of pipe used,	
Iron, cement-lined, adamanta, galvanized iron and lead-lined	
Size of pipe used,	$\frac{1}{4}$ to 10 inches in diameter.
Extended,	5,446
Discontinued,	820
Numbered of services added,	98
Number of services discontinued,	20
Number of services now in use,	11,452
Total length of services,	93 miles, 1,978 feet.
Number of services added in Saugus,	37
Number of services now in use in Saugus,	839
Length of services added in 1898,	1,566
Total length of services in Saugus,	8 miles, 534 feet.
Meters added,	206
Meters now in use,	2,074

28th
4 1912

ANNUAL REPORT

OF THE

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AND
TILDEN FOUNDATIONS

PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1899



LYNN, MASS.
WHITTEN & CASS, PRINTERS,
1900.

1000

ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1899



LYNN, MASS.
WHITTEN & CASS, PRINTERS,
1900.

OFFICERS FOR 1899.

W. B. LITTLEFIELD, *Pres.*
For one year.

S. W. DEARBORN,
For two years.

JAMES BURNS,
For three years.

D. A. SUTHERLAND,
For four years.

THOS. P. NICHOLS,
For five years.

Superintendent and Clerk, JOHN C. HASKELL.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, GEO. H. VENN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. MCCLAIN.

<i>Inspectors</i>	{	WINSLOW J. ROWELL,
		J. FRANK POOL,
		W. B. MOULTON,
		JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1900.

S. W. DEARBORN, for one year.

JAMES BURNS, for two years.

D. A. SUTHERLAND, for three years.

THOS. P. NICHOLS, for four years.

W. B. LITTLEFIELD, *Pres.*, for five years



ANNUAL REPORT.

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1900. }

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-eighth annual report, together with the reports of the Superintendent and Registrar.

Water Supply.

The construction of our system of water supply was commenced in 1870. The first source of supply was Breed's Pond, which, when full, has 22 feet of water at the dam. It contains 54.85 acres of water surface, a total storage capacity of 262,563,340 gallons, a water-shed, including pond surface, of .93 square miles.

Birch Pond has a depth of 21.50 feet of water at dam, and a pond surface of 82 acres, with a water-shed area, including the pond, of .66 square miles, a total storage capacity of 381,062,901 gallons.

In 1886 a pumping station was erected at the upper end of Birch Pond over the canal, equipped with a steam-engine and boiler of 60 horse power, and a Webster 15-inch centrifugal pump capable of pumping 12,000,000 gallons of water daily from the canal into the pond. This became necessary in order to fill Birch and Breed's Ponds when they were unable to fill from their own water-shed.

Walden Pond, when full, has 17 feet of water at dam, a pond surface of 128 acres, and a water-shed, including pond surface, of 1.31 square miles, a storage capacity of 403,163,826 gallons.

Glen Lewis Pond has a depth of 17 feet, with a pond surface of 36 acres, a water-shed, including pond surface, of .36 square miles, and a storage capacity of 120,475,126 gallons.

Hawkes' Pond has a depth of 25 feet, with a pond surface of 75 acres, a water-shed, including pond surface, of 1.92 square miles, and a storage capacity of 300,000,000 gallons. This total area of 5.18 square miles of water-shed has a total storage area of 1,467,265,193 gallons.

By an Act of Legislature, passed May 27, 1894, authority was granted to the City of Lynn to take Saugus River and its tributaries, except Lake Quannapowitt and Crystal Lake in Wakefield, as an additional water supply. This addition comprises a water-shed of 22.91 square miles, or over four times as great an area as that required at present to supply our yearly consumption.

In the general development of our present water supply a conduit has been constructed from Saugus River to Hawkes' Pond, commencing at the river, from a point just above the railroad at Montrose, and running to the upper end of Hawkes' Pond. This conduit consists of 2,430 feet of open canal, 220 feet concrete conduit, 200 feet stone culvert, and 730 feet tunnel, having a capacity for delivering 30,000,000 gallons of water daily from Saugus River to Hawkes' Pond.

The water-shed contributing this supply contains less than 50 inhabitants to the square mile, and is entirely free from all direct sewage contamination.

To improve the quality of the water from this area, the entire bed of the Saugus River has been lowered and thoroughly cleaned of all obstructions that might serve to impede the flow or injure the character of the water. The work of draining all swamps within the water-shed was commenced in 1898 and will be continued to its completion. A marked improvement is shown in the quality of water in the area where the drainage work is completed.

With the view to ascertain the number of cases of typhoid fever that might be caused by the public water supply, a careful investigation of every case of typhoid fever occurring during the year was made as soon as reported. When the facts pertinent to the case could be ascertained, a general list of questions was prepared, covering the principal features to constitute an infection of typhoid fever.

The following blank shows the form adopted :

TYPHOID FEVER IN CITY OF LYNN.

Typhoid Fever Case No..... in the City of Lynn, since Jan. 1,.....
 Date when case was reported.....
 Date of physician's first visit.....

Of the thirteen deaths occurring from typhoid fever during the year of 1899, three were imported from out of town, one was from secondary infection, three from eating raw oysters, and six were of unknown origin. In no case, either among the deaths or of those that recovered, was there one that could be traced to the water supply. The character of the water furnished for consumption was better than in any previous year.

The large consumption of water during the summer months so nearly reached the entire capacity of the supply main from Birch Pond to the pumping station that it was deemed advisable to add another supply main at the side of the old one, as originally intended. The pipe necessary has been delivered and will be laid early in the season.

On January 1, 1899, our storage reservoirs contained a total of 1,375,000,000 gallons of water. The consumption of water during the year amounted to 1,961,347,170 gallons. The amount of water in store on January 1, 1900, is 464,000,000 gallons, a decrease in the amount of water stored in our reservoirs during the year of 911,000,000 gallons. This large decrease in the amount of water stored shows conclusively that additional storage capacity will be needed in our reservoirs in the immediate future. All possibility of any lack of a sufficient amount of water during the dryest year that might occur should be removed. The

460,000,000 gallons of water stored on the first of January, 1900, practically represents the surplus for the year 1899.

The increased consumption over the previous year was 231,103,345 gallons. Should this relative rate of increase in the consumption continue for the next two years, and the amount of rainfall for the year prove to be no greater than during the present year, this surplus amount of water we now have on hand would be surely exhausted, and the city would experience a water famine.

The most feasible opportunity to provide additional storage capacity in our system of water supply is to raise the dam at Walden Pond. Surveys are now in progress to ascertain the greatest height practicable to raise the dam.

To insure the greatest degree of purity in the water impounded in the new reservoir, the soil should be removed from its bed. A large proportion of this material would be utilized in the construction of the dam. As more than one season would be required to complete this undertaking, the Board recommend that the work of raising Walden Pond dam should be commenced in the present year.

Biological.

Weekly biological examinations have been made of the top and bottom water in all of the reservoirs and from a tap at the City Hall during the year. The purity of the supply is improving.

Street Mains.

During the year cement-lined pipe has been replaced with cast-iron pipe in the following streets:

Chestnut, Friend, Franklin, Highland avenue, High Rock, Laighton, Lewis, Liberty, Mt. Pleasant, Ridgeway, Rockland, Rockaway, Shepard, South Common and Western avenue.

Water Supply for Fire Purposes.

The City of Lynn is exceptionally well provided with a water supply for fire purposes. The water is delivered from the dis-

tributing reservoir on Pine Hill by three mains, 30-inch, 24-inch and 16-inch respectively, to Walnut street at the pumping station. From the pumping station a 20-inch main extends through Walnut, Winter, Cedar, Mall and North Common streets, City Hall square, Central avenue to Andrew street, and through Liberty from Central avenue to Willow street. A 16-inch main from the pumping station passes through Walnut, North Federal, Marion, Centre, Elm, Summer and Andrew streets, connecting at that point with a 20-inch main, then through Central avenue and Union street to Silsbee street.

A 12-inch pipe from the 30-inch main at the pumping station is laid through Walnut, Kirtland, Marion, Federal and North Common streets, connecting with the 20-inch main at Mall street. A 12-inch main from the reservoir for the high service runs down the Reservoir road to Linwood street, thence through Tapley street, Woodlawn street, Lover's Leap avenue, Forest, North Franklin and Franklin streets, Western avenue to Washington street, where it is connected to the low service and can be used if necessary.

In the business part of the city 1,000,000 gallons per hour can be delivered if necessary.

Land Purchased in 1899.

Caroline O. Plummer	4.62 acres
Joshua Coburn	14. acres
John W. Danforth	4.25 acres

Statement.

WATER DEBT.

Amount of debt, Dec. 20, 1898	\$1,835,300 00	
Bonds issued in 1899	25,000 00	
	<hr/>	\$1,860,300 00
Bonds paid in 1899		50,000 00
		<hr/>
Amount of debt, Dec. 20, 1899		\$1,810,300 00

SINKING FUNDS.

Amount of funds, Dec. 20, 1898	\$426,141 26	
Received from Treasurer, 1899	60,550 82	
Income from investments in 1899	12,361 80	
	<hr/>	
	\$499,053 88	
Deduct amount paid on bonds in 1899	50,000 00	
	<hr/>	
Amount in hands of Commissioners, Dec. 20, 1899	\$449,053 88	
Balance in hands of Treasurer, Dec. 20, 1899,	44,006 13	
	<hr/>	\$493,060 01

Treasurer's Statement for the Year Ending Dec. 20, 1899.

RECEIPTS.

From water rates	\$189,945 03	
From premiums on loans	4,042 50	
From accrued interest on bonds sold	177 78	
From over drafts	10 40	
	<hr/>	\$194,175 71

EXPENDITURES.

For maintenance	\$75,173 34	
For interest	74,996 24	
	<hr/>	150,169 58
Net income		<hr/>
		\$44,006 13

Respectfully submitted,

WILLIAM B. LITTLEFIELD,
President.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
Lynn, Mass., January 1, 1900. }

To Wm. B. Littlefield, President:

SIR,—I herewith present the financial condition of the department for the year ending December 31, 1899.

RECEIPTS FOR 1899.

Fixture rates	\$117,459 58
Meter rates	64,800 19
Additional rates	2,292 91
Miscellaneous	5,908 02
Fines	43 60
Total revenue	<hr/> \$190,504 30
Extra pipe	2,126 50
Total receipts as per cash book	<hr/> \$192,630 80

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$190,504 30
Amount outstanding, fixture rates	\$16,935 44
Amount outstanding, meter rates	6,295 40
Amount outstanding (not due) meter rates	16,251 23
	<hr/> 39,482 07
	<hr/> \$229,986 37
Deduct amount due January 1, 1899	36,287 36
Revenue for 1899	<hr/> \$193,699 01
Revenue for 1898	186,658 35
Increase	<hr/> \$7,040 66

STATEMENT OF NET EARNINGS FOR 1899.

Revenue		\$193,699 01
EXPENSES		
Interest	\$74,996 24	
Maintenance	70,633 68	
Rebate to Saugus	4,049 39	
		<u>149,679 31</u>
Net earnings		\$44,019 70

EXPENDITURES FOR THE YEAR 1899.

MAINTENANCE.		
*Execution, N. W. Green	\$16,244 32	
Pumping	10,224 07	
Mains	9,777 33	
Salaries and office	8,919 04	
Services	6,873 77	
Engines and boilers	5,452 80	
Meters	4,716 78	
Stable and shop	2,329 66	
Legal (tubular wells)	976 10	
Damages	824 77	
Taxes, Saugus and Lynnfield	791 94	
Walden Pond	747 94	
Hawkes' Pond	667 39	
Engineering	602 50	
Engine house	513 34	
Conduit	449 75	
Laboratory	227 06	
Birch Pond	163 49	
Breed's Pond	83 13	
Reservoir	68 50	
		<u>\$70,633 68</u>
CONSTRUCTION		
Mains	\$20,568 87	
Services	5,143 56	
Hawkes' Pond canal	3,032 97	
Hawkes' Pond	1,878 03	
		<u>\$30,623 43</u>
Less amount received for pipe		2,126 50
Net		<u>\$28,496 93</u>

*The final settlement in the Nelson W. Green case (execution) \$16,244.32 has reduced our net earnings which accounts for our falling off from last year.

STATEMENT.

SHOWING COST OF WORKS TO JANUARY 1, 1900.

Mains, hydrants and gates	\$869,913 55
New supply and land	337,390 75
Services and courts	299,260 75
Walden and Glen Lewis Ponds	185,179 42
Engines and boilers	140,327 29
Hawkes' Pond	159,310 59
Reservoirs and land	131,581 49
Birch Pond and land	93,471 84
Engine house and land	57,562 39
Breed's Pond and land	57,135 28
Pipe conduits and land	45,293 98
Hawkes' Pond canal	43,836 65
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,274 07
Highland service	12,431 17
Tubular wells	9,470 02
Engineering	9,246 17
Work shop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,567,334 93
Less amount received for pipe	139,773 50
	<hr/>
Total net cost	\$2,427,561 43

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,554	
• Number of services in Saugus	893	
Total	<u> </u>	12,447
Number put in during the year (Lynn)	161	
Number put in during the year (Saugus)	50	
Total	<u> </u>	211
Number extended during the year (Lynn)	34	
Number extended during the year (Saugus)	4	
Total	<u> </u>	38
Renewed	11	
Number discontinued	27	
Number not in use	88	
Turned on (new services)	122	
Turned on (reoccupied)	345	
Turned on (rates and fines paid)	10	
Shut off (for vacancy)	437	
Shut off (for non-payment)	53	
Shut off (for repairs)	51	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
CONTAINED IN THE SAME, TOGETHER WITH THE
NUMBER OF FIRE HYDRANTS, DEC. 31, 1899.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	11,587	849	12,436
Stores and shops	1,195	42	1,237
Factories	185	2	187
Offices	475	15	490
Restaurants and saloons	79	..	79
School-houses	52	7	59
Churches	29	5	34
Bakeries	32	..	32
Laundries	20	..	20
Engine houses	11	3	14
Families	16,117	941	17,058
Boarding-houses	221	2	223
Faucets	30,518	1,694	32,212
Water-closets	13,607	490	14,097
Bath tubs	5,320	319	5,639
Hose bibs	3,117	148	3,265
Urinals	189	8	197
Heaters	854	51	905
Stationary engines	157	6	163
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	29	..	29
Stand-pipes for fire purposes	16	1	17
Stand-pipes for water-carts	72	..	72
Sewer connections	21	..	21
Automatic sprinklers	91	2	93
Hydrants	798	146	944
Hydrants for car sprinklers	37	..	37

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	.	.	.	\$8,989	00
From January 1, 1872, to January 1, 1873	.	.	.	27,568	15
From January 1, 1873, to January 1, 1874	.	.	.	47,992	61
From January 1, 1874, to January 1, 1875	.	.	.	53,545	61
From January 1, 1875, to January 1, 1876	.	.	.	52,553	26
From January 1, 1876, to January 1, 1877	.	.	.	60,807	12
From January 1, 1877, to January 1, 1878	.	.	.	64,002	50
From January 1, 1878, to January 1, 1879	.	.	.	67,570	14
From January 1, 1879, to January 1, 1880	.	.	.	73,949	80
From January 1, 1880, to January 1, 1881	.	.	.	79,635	12
From January 1, 1881, to January 1, 1882	.	.	.	80,967	76
From January 1, 1882, to January 1, 1883	.	.	.	94,419	52
From January 1, 1883, to January 1, 1884	.	.	.	98,593	54
From January 1, 1884, to January 1, 1885	.	.	.	114,903	86
From January 1, 1885, to January 1, 1886	.	.	.	110,089	11
From January 1, 1886, to January 1, 1887	.	.	.	116,375	70
From January 1, 1887, to January 1, 1888	.	.	.	123,507	73
From January 1, 1888, to January 1, 1889	.	.	.	134,480	27
From January 1, 1889, to January 1, 1890	.	.	.	141,865	53
From January 1, 1890, to January 1, 1891	.	.	.	154,788	27
From January 1, 1891, to January 1, 1892	.	.	.	171,744	85
From January 1, 1892, to January 1, 1893	.	.	.	188,979	88
From January 1, 1893, to January 1, 1894	.	.	.	177,803	56
From January 1, 1894, to January 1, 1895	.	.	.	176,655	50
From January 1, 1895, to January 1, 1896	.	.	.	185,572	88
From January 1, 1896, to January 1, 1897	.	.	.	190,531	33
From January 1, 1897, to January 1, 1898	.	.	.	183,711	97
From January 1, 1898, to January 1, 1899	.	.	.	186,658	35
From January 1, 1899, to January 1, 1900	.	.	.	193,699	01
				\$3,362,321	94

FUNDED WATER LOAN.

When Payable.					Rate. Per Cent.	Amount.
Jan.	1, 1900	.	.	.	5	\$50,000
Apr.	1, 1900	.	.	.	4	10,000
Jan.	1, 1901	.	.	.	5	50,000
Mar.	1, 1903	.	.	.	4	8,000
May	1, 1904	.	.	.	3½	7,300
Dec.	1, 1904	.	.	.	4	25,000
Jan.	1, 1905	.	.	.	5	200,000
Apr.	1, 1905	.	.	.	4	150,000
May	1, 1905	.	.	.	3½	66,500
Dec.	1, 1905	.	.	.	3½	5,000
Nov.	1, 1913	.	.	.	4	20,000
Nov.	1, 1913	.	.	.	3½	31,000
Mar.	15, 1914	.	.	.	4	50,000
Dec.	1, 1914	.	.	.	4	20,000
Dec.	1, 1915	.	.	.	3½	6,000
Apr.	1, 1916	.	.	.	3½	2,000
May	1, 1916	.	.	.	3½	24,500
Sept.	1, 1916	.	.	.	4	10,000
Oct.	1, 1916	.	.	.	4	9,000
Feb.	1, 1917	.	.	.	3½	6,500
June	1, 1917	.	.	.	3½	3,500
July	1, 1917	.	.	.	4	7,500
Aug.	1, 1917	.	.	.	4	5,000
Oct.	1, 1917	.	.	.	4	2,000
Nov.	1, 1917	.	.	.	4	6,500
Apr.	1, 1918	.	.	.	4	15,000
June	1, 1918	.	.	.	4	10,000
July	1, 1918	.	.	.	4	50,000
Apr.	1, 1919	.	.	.	4	100,000
July	1, 1919	.	.	.	4	110,000
Jan.	1, 1920	.	.	.	4	35,000
Apr.	1, 1920	.	.	.	4	150,000
Apr.	1, 1921	.	.	.	4	50,000
Oct.	1, 1921	.	.	.	4	25,000
Jan.	1, 1922	.	.	.	4	50,000
July	1, 1922	.	.	.	4	25,000
Apr.	1, 1923	.	.	.	4	40,000
July	1, 1925	.	.	.	4	165,000
July	1, 1926	.	.	.	4	50,000
Sept.	1, 1927	.	.	.	4	25,000
July	1, 1928	.	.	.	.	25,000
Oct.	1, 1928	.	.	.	.	10,000
Note (on demand)		.	.	.	4	100,000
						<hr/>
						\$1,810,300

REPORT OF SUPERINTENDENT.

To Wm. B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1899.

Water Supply.

On January 1, 1899, Breed's Pond contained 193,000,000 gallons of water; Birch Pond, 353,000,000 gallons; Walden Pond, 419,000,000 gallons; Glen Lewis Pond, 137,000,000 gallons; Hawkes' Pond, 273,000,000; a total of 1,375,000,000 gallons.

The supply for the year was taken from the various sources as follows:

Breed's Pond	388,073,731 gallons
Birch Pond	668,946,193 "
Hawkes' and Walden Ponds	904,327,246 "
Total	<hr/> 1,961,347,170 gallons

This is an increase of 229,126,318 gallons over the consumption during 1898. This large increase is principally due to an especially dry summer.

On January 1, 1900, Breed's Pond contained 129,000,000 gallons of water; Birch Pond, 52,000,000 gallons; Hawkes' Pond, 68,000,000 gallons; Walden Pond, 92,000,000 gallons; Glen Lewis Pond, 123,000,000 gallons; a total of 464,000,000 gallons, a decrease of stored water in the reservoirs during the year of 1899 of 911,000,000 gallons.

The water supplied for consumption was of the best character throughout the entire year.

Canal.

The water was drawn from the canal and tunnel, which, on inspection, was shown to be in good condition.

Pumping Station.

The galvanized cap near the top of the chimney at the pumping station, which had become badly rusted, has been thoroughly repaired, and a new top of copper has been put on, also a strong cast-iron cap has been bolted around the brick-work at the top of the chimney. On inspecting the L. Loretz pumps in July it was found that the plunger had become worn, and it was decided to remove the plunger, have the pump rebored and new plungers of brass substituted in place of the old plungers, which has been done in a thorough manner, under the direction of Mr. A. L. L. Loretz, the builder of the engine.

The high service pumps have also been thoroughly overhauled, new joints having been made and new valves of improved pattern put in the pumps. The work is not yet completed. The engine will be put in thorough repair, which will make it practically as good as new.

The steam valves on the auxiliary have been taken out and the seats rebored.

The Belpair boiler developed a leak around one of the stay bolts, and it was found necessary to remove some of the asbestos covering on the outside and have them caulked, which was done, the stay bolts being made perfectly tight and the covering replaced. A drain has been laid from the pit below the Loretz engine to the back yard, to carry off the water that accumulates under the engine.

The bridge over the overflow from Glen Lewis pond was replaced with a new one, and the bridge from the crest of the dam at Walden Pond to the gate house was also replaced with a new one.

During the year 12,944 feet of cement-lined pipe was taken up and replaced with cast-iron pipe mains on the following streets: Adams, Chestnut, Friend, Franklin, High Rock, Loughton, Lewis, Liberty, Mt. Pleasant, Ridgeway, Rockland, Rockaway,

Shepard, South Common, Highland avenue and Western avenue. One thousand four hundred and twenty-two feet of cast-iron pipe has been laid as petitioned for in the following streets: Gas House road, Gertrude street, Grosvenor Park, Locust street and Wenuchus avenue.

During the year six gates have been set in connection with the new mains; seven new gates replaced old ones; 17 street sprinklers were repaired; 38 hydrants were repaired; 39 leaks in hydrants were repaired; eight new hydrants replaced old ones; two new hydrants were put in; 68 main gate boxes were raised where streets were graded; 154 feet of ledge was excavated in trenching; 161 services were put in, aggregating 7,517 feet in length; 134 were extended a length of 1,145 feet; 27 were discontinued; 44 services were renewed; 289 services were changed from the old pipe to the new; 19 services were lowered; 72 service boxes were changed where streets were graded; 112 new gate boxes were put in; 1,010 corporations were cleaned out; 275 lead pieces were put in in place of old ones; 140 iron stop boxes were reset; 289 leaks in service pipe were repaired; 348 services were cleaned out; 128 services were thawed out; 31 stop and wastes were put in to replace old ones; 26 private hydrants were repaired, six drinking fountains were repaired; 297 meters were set; 42 meters were changed; eight new meter boxes replaced old ones; seven new outside meter boxes were put in; 140 meters were repaired.

The following tables show the work performed by the department during the year.

Respectfully submitted,

JOHN C. HASKELL,

Superintendent.

Microscopical Examination of Water from Birch Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 14.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25940	26169	26396	26723	27039	27432	27732	28086	28564	28956	29287	29625
Plants.												
DIATOMACEÆ:	0	17	4	3	124	234	60	78	382	111	102	105
Asterionella	0	4	3	0	0	18	0	72	264	14	5	10
Cyclotella	0	5	0	3	0	210	56	0	4	4	5	4
Stephanodiscus	0	0	1	0	110	0	0	0	0	0	0	0
Synedra	0	0	0	0	4	3	0	2	0	0	3	74
Tabellaria	0	8	0	0	10	2	4	4	114	86	82	16
CYANOPHYCÆ:	0	0	0	0	0	3	8	78	164	10	59	0
Anabaena	0	0	0	0	0	3	4	70	92	10	59	0
Merisinopædia	0	0	0	0	0	0	0	0	72	0	0	0
ALGÆ:	0	0	0	0	1	15	0	84	42	18	2	12
Animals.												
RHIZOPODA:	0	0	0	0	0	1	0	0	2	0	0	0
INFUSORIA:	0	20	4	7	20	3	2	14	38	9	6	21
Dinobryon	0	0	1	0	0	1	2	2	26	0	0	0
Mallomouas	0	0	1	1	18	0	0	2	4	0	1	6
Peridinium	0	11	1	5	2	0	0	2	0	2	2	1
Uroglena	0	0	0	0	0	0	0	0	0	0	0	pi.
VERMES:	0	1	2	0	2	0	4	6	2	2	1	4
CRUSTACEA:	0	0	pi.	0	0	0	0	pi.	pi.	0	0	pi.
MISCELLANEOUS:	0	3	12	7	10	5	3	7	8	7	3	7
Total	0	41	22	17	157	261	77	257	638	157	173	149

Microscopical Examination of Water from Breed's Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25904	26770	26397	26722	27040	27433	27733	28087	28565	28957	29288	29626
Plants.												
DIATOMACEÆ:	7	5	0	22	72	275	216	154	362	266	13	22
Asterionella	6	4	0	8	48	216	134	108	186	30	6	8
Tabellaria	0	0	0	1	16	44	22	12	174	210	4	8
CYANOPHYCEÆ, Anabæna	0	0	0	0	14	3	0	176	36	6	0	0
ALGÆ:	0	0	0	0	0	5	14	78	26	22	0	0
Animals.												
INFUSORIA:	4	7	2	9	135	25	34	19	14	2	1	37
Dinobryon	4	0	0	0	114	21	28	0	4	0	0	36
Raphidomonas	0	0	0	0	0	2	0	1	10	0	0	0
Uroglena	0	0	0	1	16	0	0	0	0	0	0	0
VERMES:	0	1	1	0	2	3	0	3	12	6	0	0
Anurea	0	1	1	0	0	1	0	0	12	4	0	0
CRUSTACEA:	0	0	pi.	0	0	pi.	0	pi.	pi.	0	0	pi.
Bosmina	0	0	0	0	0	0	0	pi.	0	0	0	0
Cyclops	0	0	0	0	0	pi.	0	0	pi.	0	0	pi.
Daphnia	0	0	pi.	0	0	0	0	0	0	0	0	0
MISCELLANEOUS, Zoogloæa	0	3	15	10	7	7	7	7	5	10	3	3
Total	11	16	18	41	230	318	271	437	455	312	17	62

Microscopical Examination of Water from Glen Lewis Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 12.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25905	26171	26368	26724	27043	27434	27734	28088	28506	28958	29289	29629
Plants.												
DIATOMACEÆ:	5	0	0	36	135	20	368	144	456	308	520	758
Asterionella	0	0	0	32	104	8	24	32	0	156	124	18
Melosira	0	0	0	0	3	6	340	100	450	140	168	0
Synedra	4	0	0	0	0	1	0	8	0	12	220	720
CYANOPHYCEÆ:	2	1	6	12	14	53	308	932	492	152	4	0
Analema	0	0	0	0	4	0	52	470	44	16	0	0
Clathrocystis	0	0	3	2	6	52	312	436	428	130	4	0
Cætosphaerium	2	1	2	0	0	0	4	0	20	0	0	0
Microcystis	0	0	1	10	4	1	0	20	0	0	0	0
ALGÆ:	0	2	0	74	288	300	272	502	348	1028	192	28
Cælastrum	0	0	0	0	2	0	0	108	48	0	0	0
Protooccus	0	0	0	74	280	0	56	80	64	0	0	17
Raphidium	0	2	0	0	2	1	8	4	0	96	48	7
Scenedesmus	0	0	0	0	0	0	0	12	20	860	110	2
Staurastrum	0	0	0	0	2	388	110	340	130	28	0	0
Animals.												
INFUSOEA:	584	50	21	270	30	3	48	200	44	30	210	20
Cryptomonas	36	4	0	20	0	0	0	4	0	20	0	0
Dinobryon	298	17	0	84	32	0	0	0	0	0	108	4
Euglena	0	0	0	120	0	0	0	0	0	4	20	2
Mallomonas	0	0	0	4	2	0	0	0	0	0	20	0
Monas	0	0	0	20	0	1	0	8	0	0	0	0
Peridinium	248	6	7	8	2	0	8	4	0	0	0	28
Trachelomonas	2	17	1	10	0	2	30	184	44	8	0	0
VERMES:	4	3	2	0	12	0	0	8	8	4	2	0
CRUSTACEA, Cyclops .	0	0	0	0	pl.	0	0	pl.	pl.	0	0	0
Daphnia	0	0	0	0	pl.	0	0	0	0	0	0	0
MISCELLANEOUS,												
Zooglyca	0	3	7	20	12	3	20	30	5	24	0	3
Total	308	60	30	418	500	475	1075	1882	1353	1552	811	818

Microscopical Examination of Water from Hawkes' Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25906	26172	26399	26725	27041	27435	27735	28089	28567	28959	29290	29627
Plants.												
DIATOMACEÆ:	0	1	0	14	96	54	40	322	56	220	152	83
Cyclotella	0	0	0	0	0	0	7	144	2	6	14	0
Synedra	0	1	0	5	82	48	30	142	54	170	86	60
CYANOPHYCEÆ:	0	0	0	0	0	4	0	16	2	2	0	0
Sphærozyga	0	0	0	0	0	0	0	14	0	0	0	0
ALGÆ:	0	4	4	0	27	0	0	56	24	18	12	0
Animals.												
RHIZOPODA:	0	0	0	0	0	1	0	4	2	1	0	0
INFUSORIA:	7	813	323	66	50	284	20	6	2	202	83	15
Ciliated infusorian . .	0	800	0	0	0	0	0	0	0	0	0	0
Dinobryon	0	2	77	60	42	79	19	0	0	44	60	0
Euzlena	1	3	11	1	2	0	0	0	0	0	14	0
Peridinium	6	37	234	4	2	200	1	6	0	150	4	8
VERMES:	0	0	6	3	2	1	0	5	0	0	4	1
CRUSTACEA:												
Cyclops	0	0	0	0	0	pi.	pi.	pi.	0	0	0	0
Bosmina	0	0	0	0	0	0	0	pi.	0	0	0	0
MISCELLANEOUS, Zooglaea	0	8	10	8	12	7	15	35	5	15	5	5
Total	7	856	343	91	187	351	75	441	91	458	256	104

Microscopical Examination of Water from Howlett's Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25907	26173	26400	26726	27042	27436	27736	28090	28568	28960	29291	29628
Plants.												
DIATOMACEÆ:	2	7	33	51	93	17	368	112	116	70	31	2
Cyclotella	0	0	0	1	0	0	36	74	4	0	5	0
Synedra	0	3	14	32	62	15	332	20	12	68	6	0
CYANOPHYCEÆ:	0	0	0	0	0	0	2	2	0	0	2	0
ALGÆ:	0	0	0	7	2	11	72	4	0	0	1	0
FUNGI, Crenothrix . .	0	0	0	0	10	0	0	10	0	500	12	0
Animals.												
RHIZOPODA:	0	0	0	0	0	0	2	0	0	0	0	0
INFUSORIA:	6	62	7	12	2	20	12	5	2	2	0	48
Dinobryon	0	39	5	5	0	0	6	0	0	0	0	0
Monas	0	0	0	0	2	9	0	4	0	0	0	42
Peridinium	3	23	2	1	0	0	0	0	0	0	0	2
VERMES:	0	0	0	2	0	1	0	2	0	0	0	0
MISCELLANEOUS, Zooglyta	3	7	8	7	80	40	10	12	100	510	5	
Total	11	76	48	79	187	89	466	147	218	552	51	55

Microscopical Examination of Water from Walden Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25908	26174	26401	26727	27044	27437	27737	28091	28569	28661	29292	29630
Plants.												
DIATOMACEÆ:	0	1	0	30	174	2550	804	1056	2212	482	266	49
Asterionella	0	0	0	24	20	10	0	68	714	58	8	0
Cyclotella	0	0	0	4	0	0	20	106	22	14	0	0
Melosira	0	0	0	0	28	60	64	136	240	90	132	11
Synedra	0	0	0	0	6	2400	684	696	1150	306	110	30
Tabellaria	0	1	0	2	120	80	36	34	82	8	16	6
CYANOPHYCEÆ:	0	0	0	2	2	0	0	4	4	4	10	0
ALGÆ:	0	0	0	0	0	9	18	223	150	54	86	11
Protococcus	0	0	0	0	0	0	16	200	130	24	72	8
Animals.												
RHIZOPODA:												
Actinophrys	0	0	0	0	0	10	0	0	0	0	0	0
INFUSORIA:	62	54	30	284	230	34	8	62	6	34	10	12
Ciliated infusorian . .	0	7	0	0	0	0	0	16	0	0	0	0
Cryptomonas	18	0	0	4	0	0	0	8	0	0	0	1
Dinobryon	12	8	9	142	222	0	0	0	2	0	0	0
Euglena	2	1	10	52	2	0	0	2	0	0	0	0
Peridinium	26	38	2	72	6	15	2	8	0	28	8	11
Phacus	0	0	0	0	0	0	0	10	0	0	0	0
Trachelomonas	2	0	0	2	0	18	6	4	0	2	2	0
VERMES:	3	1	4	3	7	4	2	9	4	4	10	0
CRUSTACEA:	0	0	0	0	0	pi.	pi.	pi.	0	pi.	0	0
MISCELLANEOUS, Zoogloæ	3	8	7	15	0	20	10	30	15	25	3	5
Total	68	64	41	334	413	2627	812	1384	2391	603	385	77

Microscopical Examination of Water from Saugus River at Montrose.

Number of Organisms per Cubic Centimeter.

Day of Examination, 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 13.
Number of Sample . .	25900	26175	26402	26728	27045	27138	27738	28002	28570	28962	29203	29631
Plants.												
DIATOMACEÆ:	21	10	7	121	62	25	120	15	16	46	1	27
Synedra	1	5	0	67	50	18	96	10	8	2	1	20
CYANOPHYCÆ:	0	0	0	0	0	1	1	0	0	0	0	0
ALGÆ:	0	0	0	1	2	0	0	16	0	2	0	21
FUNGI:	0	0	0	0	16	32	0	0	56	80	50	0
Animals.												
RHIZOPODA:	0	0	0	1	0	1	0	0	0	0	0	0
INFUSORIA:	0	705	8	11	0	2	0	3	0	28	0	180
Dinobryon	0	690	0	8	0	0	0	0	0	18	0	178
Peridinium	0	11	8	1	0	0	0	0	0	0	0	1
VERMES:	0	0	0	1	2	0	0	0	0	0	0	1
MISCELLANEOUS, Zoogloea	5	5	5	7	10	3	3	5	3	3	0	5
Total	26	720	20	142	92	64	124	39	75	159	51	234

Microscopical Examination of Water from a Tap in Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1899.	January 11.	February 8.	March 8.	April 12.	May 10.	June 15.	July 13.	August 9.	September 13.	October 12.	November 9.	December 16.
Number of Sample . .	25910	26176	26403	26729	27046	27439	27739	28093	28571	28963	29294	29671
Plants.												
DIATOMACEÆ:	5	14	5	4	76	184	120	43	102	84	73	66
Asterionella	1	4	0	1	11	51	8	10	58	4	3	3
Synedra	0	1	1	0	13	49	94	4	0	38	0	32
Tabellaria	4	9	4	2	39	57	14	13	44	32	68	16
CYANOPHYCEÆ:	0	0	0	0	0	0	0	0	0	30	0	0
Anabaena	0	0	0	0	0	0	0	0	0	14	0	0
Merismopædia . . .	0	0	0	0	0	0	0	0	0	12	0	0
ALGÆ:	0	0	0	0	0	2	0	10	0	24	3	0
FUNGI:	0	0	0	0	10	2	0	18	18	0	0	0
Animals.												
RHIZOPODA:	0	0	0	0	0	0	0	0	2	0	0	0
INFUSORIA:	6	11	2	0	40	0	4	1	12	8	0	3
Dinobryon	0	0	0	0	33	0	2	0	2	0	0	1
Peridinium	6	11	1	0	3	0	0	0	0	8	0	0
Trachelomouas . . .	0	0	1	0	1	0	2	0	10	0	0	1
VERNES:	0	1	0	0	1	0	0	0	0	0	0	0
CRUSTACEA, Cyclops .	0	0	0	0	pi.	0	0	0	0	0	0	0
MISCELLANEOUS, Zooglaea	3	5	5	3	5	3	5	8	20	5	0	3
Total	14	31	12	7	132	191	129	70	154	151	76	72

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1899.

MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	156,734,519	5,055,952	. . . . .	. . . . .	71.51	74.35
February	147,580,125	5,270,719	. . . . .	785,233	74.55	77.51
March	150,838,650	4,865,763	. . . . .	404,956	68.82	71.55
April	141,538,759	4,717,958	. . . . .	147,805	66.73	69.38
May	161,355,005	5,205,000	487,042	. . . . .	73.62	76.54
June	190,795,179	6,359,839	1,154,839	. . . . .	89.95	93.52
July	204,708,912	6,603,513	243,674	. . . . .	93.40	97.11
August	201,236,651	6,491,505	. . . . .	112,008	91.82	95.46
September	183,455,841	6,116,194	. . . . .	375,311	86.50	89.94
October	157,754,832	5,088,865	. . . . .	1,027,329	71.08	74.83
November	133,359,324	4,445,311	. . . . .	643,554	62.87	65.37
December	133,036,400	4,320,509	. . . . .	124,782	61.11	63.54
Totals and averages	1,963,324,197	5,378,970	. . . . .	. . . . .	76.08	79.10

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1899.

MONTH.	GALLONS.			
	Breed's.	Birch.	Canal.	Total.
January	51,331,237	. . . . .	104,188,163	155,519,400
February	67,518,930	14,589,720	66,751,050	148,859,700
March	58,582,252	67,691,348	24,565,050	150,838,650
April	59,595,880	53,806,110	23,138,310	135,540,300
May	41,405,085	. . . . .	117,207,165	158,612,250
June	33,469,732	. . . . .	165,551,018	199,020,750
July	40,383,925	. . . . .	162,359,275	202,743,200
August	22,465,230	48,656,100	131,952,120	203,073,450
September . . . . .	. . . . .	184,066,050	. . . . .	184,066,050
October	14,321,460	35,785,125	108,615,095	158,721,680
November . . . . .	. . . . .	131,367,855	. . . . .	131,367,855
December . . . . .	. . . . .	132,683,825	. . . . .	132,683,885
Totals	388,073,731	668,946,193	904,327,246	1,961,347,170

TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1899.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	.	.	.	.	0.60	.	.	.	0.23	.	0.02	0.06
2	.	.	*0.70	.	.	.	.	.	0.04	.	.	.
3	.	*0.82	0.05	.	.	.	.	.	0.03	.	0.80	.
4	0.01	.	0.50	.	.	.	.	.	.	.	.	.
5	*0.01	*0.05	0.20	.	.	.	.	.	.	.	.	.
6	0.81	*0.14	*0.16	.	.	.	.	.	.	0.53	.	.
7	.	*0.20	0.46	0.71	.	0.14	.	.	.	.	.	*0.01
8	.	*0.23	.	.	0.01	.	0.84	.	0.10	0.11	.	.
9	.	.	0.01	.	.	.	0.02	.	.	0.32	.	.
10	.	.	.	.	.	.	.	0.70	.	.	.	.
11	.	.	.	.	0.01	.	.	0.05	0.21	.	1.05	.
12	.	*0.35	0.08	0.08	.	.	.	.	.	.	*0.05	0.08
13	0.12	*0.80	.	0.07	0.58	.	.	.	.	.	.	.
14	0.37	.	*0.05	0.01	.	0.12	.	.	.	.	.	0.46
15	.	.	0.70	.	.	0.48	0.05	.	.	.	0.03	0.27
16	0.81	*0.21	.	0.42	.	.	.	.	.	.	.	.
17	.	.	.	.	.	.	.	.	.	.	.	0.04
18	.	0.35	0.75	.	0.05	.	.	.	.	0.40	.	.
19	.	.	0.62	.	.	0.21	.	.	1.10	0.08	0.03	0.22
20	.	.	.	.	0.10	0.63	.	.	1.46	0.07	.	.
21	.	.	*0.02	.	0.06	.	.	.	0.28	.	.	.
22	.	.	*0.60	.	.	.	.	0.53	.	.	0.01	.
23	.	.	0.86	.	.	.	.	0.02	.	0.02	.	.
24	1.53	.	.	0.08	.	0.07	.	0.03	.	.	.	0.42
25	.	.	*0.11	0.05	.	0.13	0.60	.	0.05	.	.	.
26	.	0.11	*0.15	.	.	.	0.53	.	0.08	.	.	.
27	.	0.02	.	.	0.10	.	0.01	.	.	.	.	.
28	.	.	0.24	.	.	0.84	.	.	.	0.69	.	.
29	.	.	.	.	.	.	0.04	0.02	1.60	0.07	.	.
30	.	.	*0.12	.	0.06	.	.	.	.	0.84	.	*0.08
31	*0.07	.	.	.	.	.	.	.	.	.	.	.
Total	3.73	3.28	6.38	1.42	1.57	2.62	2.21	1.35	5.18	2.53	1.99	1.64

* Snow.

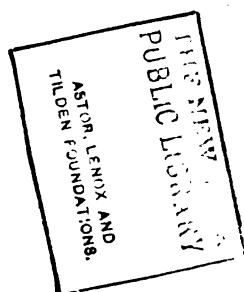
Total for the year, 33.90.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1899.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	*0.02	..	..	..	..	..	..	..	..	..	..
2	..	..	*0.09	*0.14	..	0.09	..	..	0.44	..	..	..
3	..	..	..	..	0.13	0.47	..	0.29	..	..	..	..
4	*0.19	..	*0.01	..	..	0.13	0.91	0.13	..	1.22	..	0.63
5	..	..	..	*0.28	0.30	..	..	0.56	..	..	0.20	..
6	0.17	..	*0.30	..	..	..	..	..	..	0.81	0.10	..
7	..	..	..	..	..	..	..	..	0.42	..	..	..
8	..	..	..	..	..	..	0.22	1.40	..	0.01	..	..
9	..	..	..	..	..	..	..	..	..	..	0.01	..
10	..	..	..	0.06	..	..	..	2.75	..	..	1.44	..
11	..	..	..	..	..	..	..	0.05	..	0.67	..	..
12	0.07	0.16	0.14	..	..	..	0.17	0.27	..	0.01	..	*0.29
13	..	..	..	..	..	0.23	..	..	..	..	0.19	..
14	..	..	..	0.13	0.01	..	1.86	..	..	0.47	..	..
15	*0.29	0.12	..	1.11	0.30	..	..	..	..	0.06	..	..
16	..	..	..	0.03	0.08	..	..	..	0.03	..	..	..
17	..	..	..	0.01	0.02	..	..	0.13	0.20	..	0.24	..
18	..	..	..	..	..	..	0.43	0.29	..	..	0.41	..
19	*0.15	..	0.40	0.58	..	0.23	0.01	1.33	..	0.75	1.16	*0.27
20	0.91	1.49	..	..	..	0.16	..	..	..	0.01	..	0.16
21	..	..	..	..	..	..	0.50	..	..	1.00	..	..
22	*0.77	0.04	0.05	0.10	..	..	..	..	0.44	0.45	..	0.57
23	0.27	*0.10	..	0.78	0.05	..	..	0.22	0.33	..	..	..
24	*0.55	..	..	1.58	0.92	..	0.06	0.05	0.09	..	0.35	..
25	*0.02	..	..	0.09	0.81	0.05	..	0.08	..	..	..	..
26	..	..	..	0.02	1.42	..	0.50	0.01	0.20	1.62	*0.27	..
27	..	..	..	..	0.06	..	..	..	..	..	*0.06	..
28	..	..	..	..	..	0.09	0.22	..	..	..	..	..
29	..	..	0.32	0.80	..	..	..	..	..	0.16	*0.01	..
30	0.32	0.40	0.19	0.03	*0.25	..
31	*0.83	..	*0.01	..	0.03	*0.50
Total	4.25	3.67	1.64	6.11	4.13	1.45	5.07	7.53	2.15	7.25	4.69	2.42

* Snow.



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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1899.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Lewis Pond.
January 2	23.10 $\frac{1}{2}$	19.4	21.5	17.4	18.7
January 9	24.10 $\frac{1}{2}$	20.	21.10 $\frac{1}{2}$	17.3 $\frac{1}{2}$	18.7
January 16	24.5	20.1 $\frac{1}{2}$	22.1	17.4	18.7
January 23	24.9	20.5	22.5	17.4	18.7
January 30	24.11	20.10	22.9 $\frac{1}{2}$	17.4	18.7
February 6	24.6	20.5 $\frac{1}{2}$	22.9 $\frac{1}{2}$	17.4	18.7
February 13	24.5	20.2	23.	17.3 $\frac{1}{2}$	18.7
February 20	24.4 $\frac{1}{2}$	19.8	23.1	17.3	18.7
February 27	24.5	19.5	23.	17.2 $\frac{1}{2}$	18.7
March 6	25.2	20.2	22.10	17.5	18.7
March 13	25.2	21.3	23.1	17.4 $\frac{1}{2}$	18.7
March 20	25.3	21.4	23.2	17.5	18.9
March 27	25.1 $\frac{1}{2}$	21.4	23.2	17.4 $\frac{1}{2}$	18.8
April 3	25.1	21.3	23.1 $\frac{1}{2}$	17.4	18.8
April 10	25.1 $\frac{1}{2}$	21.3 $\frac{1}{2}$	23.	17.5	18.8
April 17	25.1 $\frac{1}{2}$	21.4	22.11	17.5	18.8
April 24	24.11	20.9	22.6	17.4	18.7 $\frac{1}{2}$
May 1	24.11	20.5	22.4 $\frac{1}{2}$	17.3	18.7 $\frac{1}{2}$
May 8	24.10 $\frac{1}{2}$	20.2	22.5	16.10	18.3
May 15	24.4	19.9	22.3	17.	16.
May 22	24.1	19.4	22.3	16.6	16.
May 29	23.10	18.10	22.2	15.11	16.
June 5	23.8	18.5 $\frac{1}{2}$	22.1	15.2	16.
June 12	22.10	17.11	21.8	14.7 $\frac{1}{2}$	16.
June 19	20.7 $\frac{1}{2}$	17.6	21.6	14.6	16.
June 26	19.9	17.5	21.5	14.6	16.
July 3	18.9	17.3	21.3	13.6	16.
July 10	18.8	16.4 $\frac{1}{2}$	21.1	12.7 $\frac{1}{2}$	16.
July 17	18.7	16.	20.10 $\frac{1}{2}$	11.7	16.
July 24	18.6	15.8	20.7	10.5	15.9
July 31	18.5	15.5	20.7	9.7	15.8
August 7	17.9	14.11	20.3	8.7	15.7
August 14	16.5	14.9	20.1 $\frac{1}{2}$	8.4	15.6 $\frac{1}{2}$
August 21	16.2	14.6	19.11	7.3	15.6 $\frac{1}{2}$
August 28	16.	14.4	19.3	7.	15.7
September 4	16.	14.3	17.10	6.8	15.7
September 11	15.8	14.3	15.3	6.7	15.6 $\frac{1}{2}$
September 18	15.6	14.2	14.9	6.6	15.6
September 25	15.6 $\frac{1}{2}$	14.2	13.2 $\frac{1}{2}$	6.6	15.6 $\frac{1}{2}$
October 2	14.2	14.3	12.2	6.9	15.10
October 9	13.6	14.3	12.2	6.10	15.11
October 16	12.0	14.3	12.2	6.9	15.11
October 23	9.6	14.3	12.3	6.9	15.11
October 30	10.4	14.4	10.10	6.9	15.11
November 6	13.2	14.9	9.3	7.2	16.
November 13	15.1	14.11	7.4	7.3	16.2
November 20	14.6	15.1	7.8	7.5	16.5
November 27	13.10	15.3	8.10	7.6	16.6
December 4	12.9	15.4	8.10	7.6	16.6
December 11	11.1	15.5	8.10	7.6	16.10
December 18	10.11 $\frac{1}{2}$	15.8 $\frac{1}{2}$	8.10	7.10	17. $\frac{1}{2}$
December 25	11.3	15.11	8.11	7.11 $\frac{1}{2}$	17.2
January 1	10.9	16.1 $\frac{1}{2}$	8.10 $\frac{1}{2}$	8.	17.2

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1899.

STREET.	LOCATION.
Chestnut street ...	On north line of Logan street, 20 feet 9 inches east of west side of Chestnut street.
Gertrude street....	On south line of Glenwood street, 33 feet west of east line of Gertrude street.
Laighton street...	On east line of Franklin street, 33 feet, 6 inches north of south line of Laighton street.
Locust street.....	On north line of Collins avenue, 14 feet, 8 inches west of east line of Locust street.
Rockaway street...	On south line of Hollingsworth street, 16 feet, 8 inches east of west line of Rockaway street.
Wenechus avenue.	On south line of Collins street, 17 feet east of west line of Wenechus avenue.

TABLE VII.

LEAKS IN PIPES AND HYDRANTS.

MONTH.	SIZE OF MAINS.						Hydrants.
	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	
January	2	...	...	1	3	5	3
February . . . . .	...	...	...	...	...	2	1
March . . . . .	...	...	...	...	...	1	1
April . . . . .	...	1	...	1	11	1	2
May . . . . .	...	...	...	6	5	5	...
June . . . . .	...	2	1	1	5	7	3
July . . . . .	...	1	...	2	11	8	2
August . . . . .	...	...	1	...	4	8	1
September . . . . .	...	...	...	...	6	4	1
October . . . . .	...	...	...	1	7	2	11
November . . . . .	...	...	1	2	10	9	5
December	1	...	...	...	3	4	7
Totals	3	4	3	14	62	56	37

Total leaks, 142.

TABLE VIII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE IN 1899.

	1/2 in.	3/4 in.	1 in.	1 1/4 in.	2 in.	3 in.	4 in.	Total
Trident	367	504	41	6	6			924
Thomson Bee	94	260	39	6	1			400
Thomson	82	118	54	12	2	1	1	270
Lamtert	58	86	3		3			150
Hersey	77	62	2	1	1			143
Ball and Pitts	35	34	19					88
Union	1	27	12	10	8		14	72
Nash	54	13	1		1			69
Niagara	35	33	1					69
Columbia	43	5						48
Worthington	3	7	9	1	6	1		27
Weir	1	3	3	5	2			17
Crown	1	6	5	3				15
Neptune	7	3						10
Empire					3			3
Motors								
Totals	8	557	1,161	189	47	33	2	2,339

Total gallons metered, 340,000,000.

TABLE IX.
SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICES LAID IN 1899.

MONTH.	SIZE AND LENGTH OF PIPE.														TOTAL.			
	6 in.		4 in.		2 in.		1½ in.		1¼ in.		1 in.		¾ in.			½ in.		
	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.	No.	Feet.		No.	Feet.	
March	1	6.	..	..	..	..	..	..	2	71.8	1	22.10	..	..	4	100.6
April	1	135.6	..	..	..	..	2	52.	18	842.4	12	412.1	..	..	33	1,441.11
May	1	39.10	1	123.7	1	18.9	5	380.4	2	74.4	1	41.6	11	678.4
June	1	8.6	..	..	..	..	8	374.7	9	428.1	..	..	18	811.2
July	6	237.6	5	222.9	1	21.	12	481.3
August	1	30.	..	..	..	..	..	..	9	233.10	3	341.2	1	63.7	14	668.7
September	8	475.10	7	292.4	..	..	15	768.2
October	7	401.4	8	278.9	..	..	15	680.1
November	1	16.6	1	7.	..	..	7	527.2	6	328.7	3	76.11	18	986.2
December	1	26.6	..	..	..	..	..	..	..	..	4	254.3	16	650.7	..	..	21	931.4
Totals	1	26.6	3	171.6	3	64.10	2	130.7	3	70.9	74	3,798.10	69	3,051.6	6	203.	161	7,517.6

Lynn—34 extensions, 1,145 ft. 6 in.; 11 renewals. Saugus—50 services, 2,360 ft. 10 in.; 4 extensions, 395 ft. 6 in.

TABLE X.

SHOWING THE AMOUNT AND SIZE OF CAST-IRON PIPE LAID IN 1899.

WHERE LAID.	12 in.	10 in.	8 in.	6 in.	4 in.
Adams street				*1,575	
Chestnut street				*503	
Gas House road					219
Gertrude street					255
Grosvenor Park					232
Friend street				*514	
Franklin street	*1,350				
Highland avenue				*551	
High Rock street				*375	
Laighton street	*68				
Lewis street		*556			
Liberty street			*373		
Locust street				351	
Mt. Pleasant street					*177
Pleasant street court					114
Ridgeway street				*124	271
Rockland street					*265
Rockaway street			*1,375		
Shepard street				*440	
South Common street				*3,001	
Wenuchus street				250	
Western avenue		*525			
Totals	1,418	1,111	1,748	8,774	1,325

*Relaid.

12,044 feet relaid, 1,422 feet new.

	MILES.	FEET.
Total pipe laid in 1899		14,700
Total cement pipe taken up and replaced with cast-iron pipe		12,044
Total extension		1,422
Previously laid	110	1,422
Private pipe in Swampscott		1,738
Pipe in Saugus	17	4,025
Total supplied by the works	125	3,278

DATE.

Month

Jan . .

Feb

Mar . .

Apr . .

May . .

June . .

July . .

Aug . .

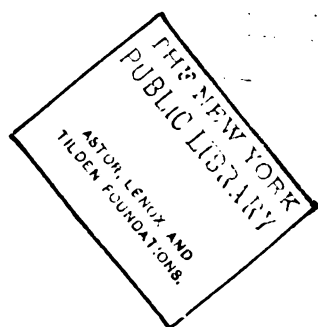
Sept . .

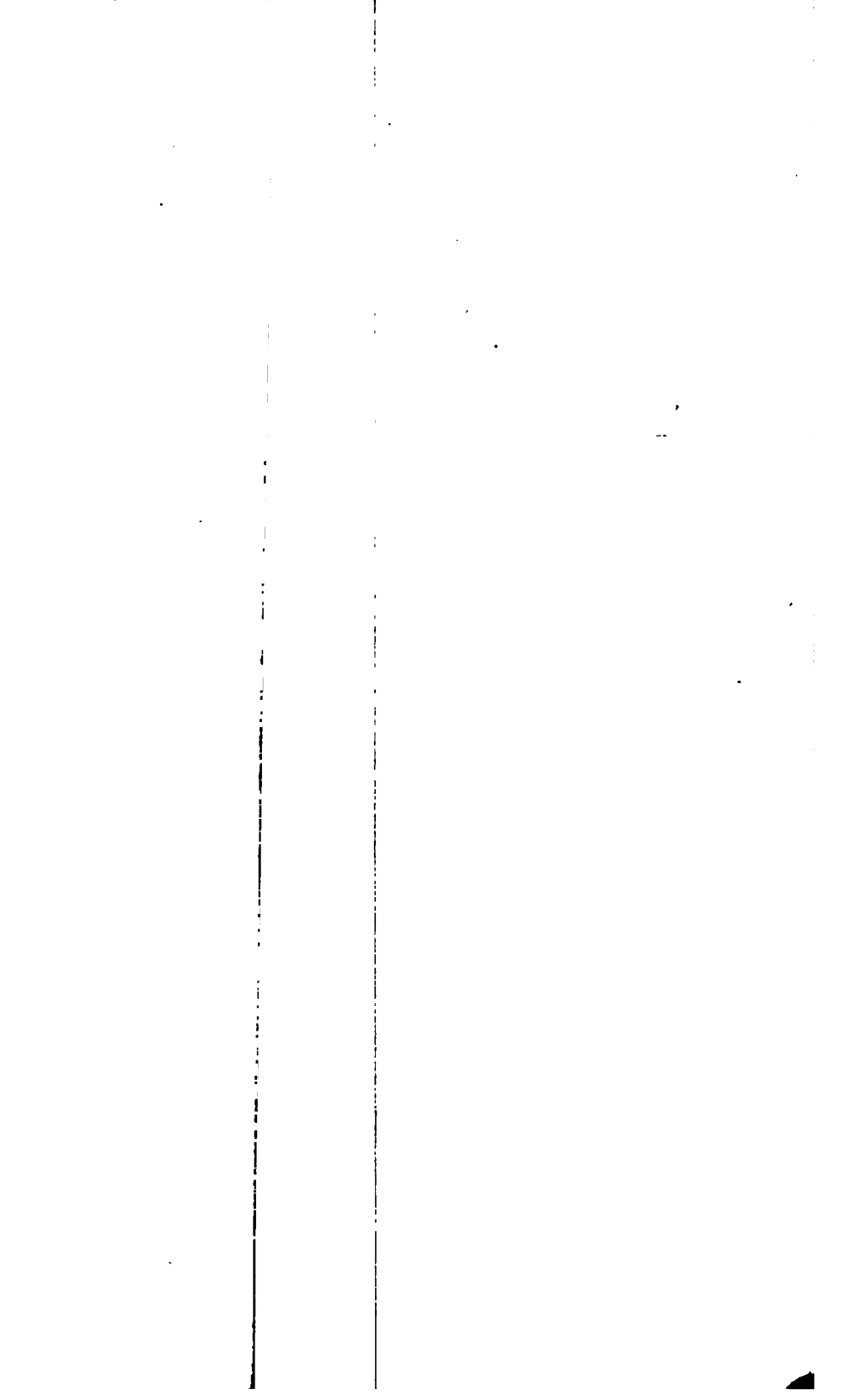
Oct . .

Nov . .

Dec . .

Totals
Average





100
FUEL
ASTORIA, OREGON
TIDEWATER

SUMMARY OF STATISTICS.

Report of 1899.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1895.

Lynn and Saugus,

66,861

Date of construction,

1870 to 1899

Owned by

City of Lynn

Source of supply,

Five artificial storage basins formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co. of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 11,500,000 daily capacity, one Loretz high service engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek

2. Cost of Coal,

\$3.25 (2,000 lbs.) delivered.
Leavitt and High. Loretz.

3. Coal consumed for the year, in pounds,

576,450 2,377,800

4. Pounds of wood consumed in pounds coal,

2.5

100

300

	Leavitt and High.	Loretz.
5. Total consumed for the year (3)+(4),	576,450	2,377,800
6. Total pumpage for the year, in gallons,	360,872,770	1,600,474,400
7. Average dynamic head against which pump works,	168.03	165.05
8. a. Number of gallons pumped per pound of coal (3)+(4),	626.00	673.00
b. Number of gallons raised 100 feet per pound of coal (3)+(4),	1,051.87	1,110.80
9. Duty, in foot pounds per 100 pounds of coal, no deductions.		
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed.}}$	87,713,632	92,640,354

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$10,776.10.

10. Per million gallons raised against dynamic head (7) into reservoir,	\$6 04
11. Per million gallons raised one foot high (dynamic),	3.67 cents.

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ. :
\$125,799.48.

12. Per million gallons raised against dynamic head (7) into reservoir,	\$72.65
13. Per million gallons raised one foot high (dynamic)	44.28 cents.

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
<i>From Consumers:</i>			
A. Water rates, domestic,	\$119,752.49	AA. Management and repairs,	\$74,683.07
B. Water rates, manufacturing,	64,800.19	BB. Interest on bonds,	74,996.24
C. Net receipts, for	\$184,552.68	CC. Total maintenance,	\$149,679.31
D. Repairs and sundries,	9,146.33	DD. Balance carried to sinking fund,	44,019.70
E. Gross receipts from all sources,	\$193,699.01	EE. Total,	\$193,699.01

CONSTRUCTION.

RECEIPTS.	EXPENDITURES.
F. From balance of 1898,	FF. Extension of main lines,
G. Pipes, meters and labor,	GG. Extension of service pipes,
H. Loans,	II. Account Hawkes Pond canal,
	JJ. Hawkes Pond land bought,
	KK. Total construction for year,
	LL. Balance,
I. Total,	MM. Total,
1. Net cost of works to date, \$2,425,285.58.	J. Bonded debt, Dec. 31, 1899, \$1,810,300.00.
K. Value of sinking fund, \$493,060 01.	L. Rate of interest, 3d, 3d, 4, 4d, 5.

CONSUMPTION.

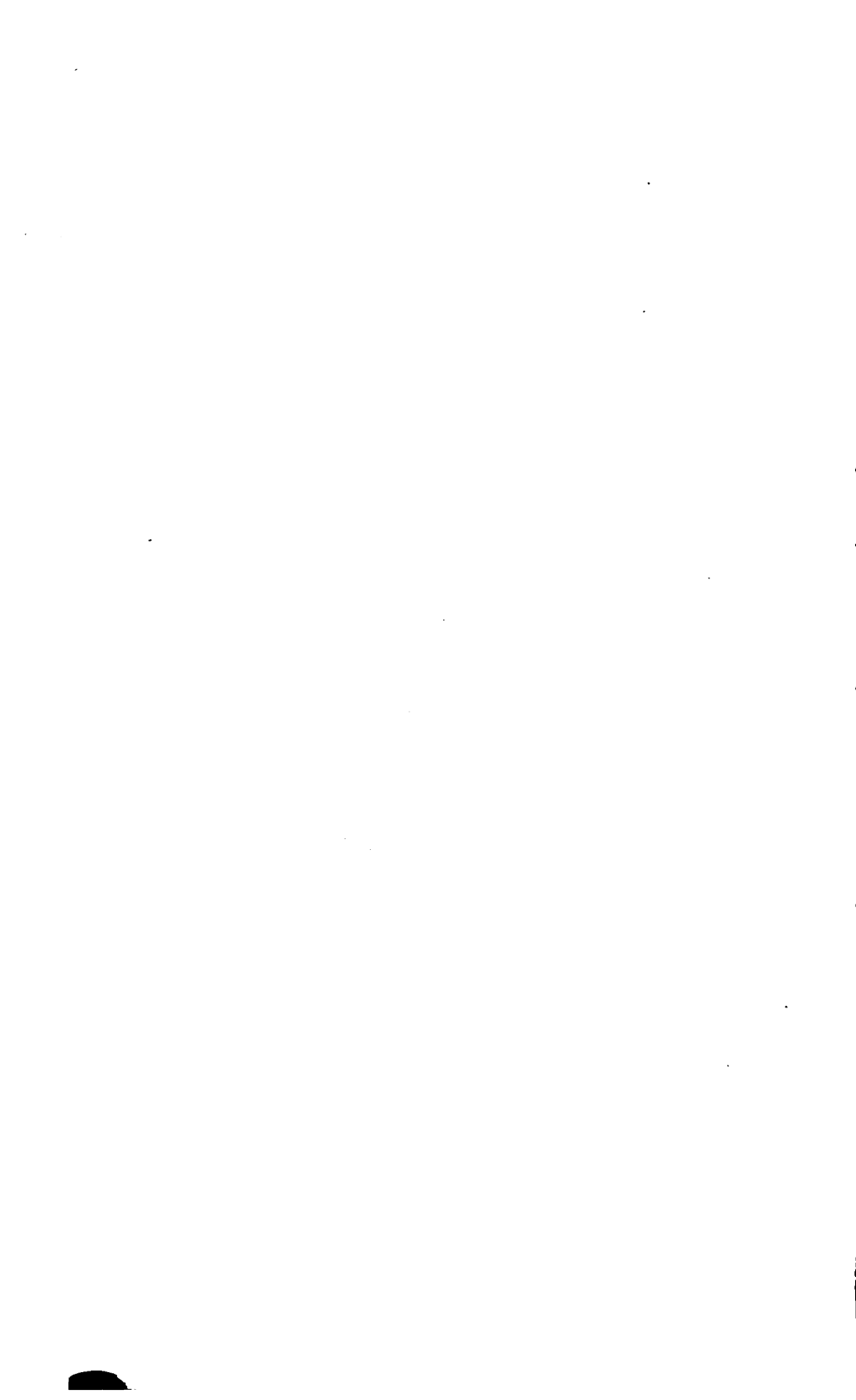
Estimated population to date (Lynn and Saugus),	70,700
Estimated population supplied,	68,000
Total number of gallons consumed for the year,	1,963,324,197
No. of gallons metered,	340,000,000
Average daily consumption in gallons,	5,378,970
Gallons per day to each consumer.	79.10

DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron.
Size,	From 2 to 20 inches diameter.
Extended,	1,422 feet.
Total now in use,	110 miles, 423 feet.
Total now in use,	Lynn, Saugus Swampscott, 128 miles, 3,278 feet.
Number of leaks for the year,	142
Hydrants added,	2
Hydrants now in use,	796
Gates added,	6
Gates now in use,	954
Range of pressure of city for day and night,	50 to 65 pounds.

SERVICES.

Kind of pipe used,	Iron, cement-lined, adamanta, galvanized iron and lead-lined
Size of pipe used,	$\frac{3}{4}$ to 10 inches in diameter.
Extended,	7,517.6
Discontinued,	1,107
Numbered of services added,	161
Number of services discontinued,	27
Number of services now in use,	11,586
Total length of services,	94 miles, 3,108 feet
Number of services added in Saugus,	50
Number of services now in use in Saugus,	889
Length of Services added in 1897,	2,361
Total length of services in Saugus,	8 miles, 2,895 feet
Meters added,	262
Meters now in use,	2,336



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1912
29
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TILDEN FOUNDATIONS.

ANNUAL REPORT

OF THE

★ PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1900.



LYNN, MASS. :
WHITTEN & CASS, PRINTERS
1901

1011



ANNUAL REPORT
OF THE
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1901

OFFICERS FOR 1900.

S. W. DEARBORN,
For one year.

JAMES BURNS,
For two years.

C. E. SPRAGUE,
For three years.

THOMAS P. NICHOLS,
For four years.

W. B. LITTLEFIELD, *President*,
For five years.

Superintendent and Clerk, D. A. SUTHERLAND.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, GEORGE H. VENN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELLOCK.

Foreman of Meters and Repairs, W. H. McLAIN.

INSPECTORS.

WINSLOW J. ROWELL,
J. FRANK POOL,

W. B. MOULTON,
JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1901.

JAMES BURNS, for one year.

C. E. SPRAGUE, for two years.

THOMAS P. NICHOLS, for three years.

W. B. LITTLEFIELD, *Pres.*, for four years.

S. W. DEARBORN, for five years.



ANNUAL REPORT.

OFFICE OF THE PUBLIC WATER BOARD, }
January 1, 1901.

*To the Honorable Mayor and City Council of the City of
Lynn:*

The Public Water Board hereby presents to the City Council its twenty-ninth annual report, together with the reports of the Superintendent and Registrar.

Water Supply.

The construction of our system of water supply was commenced in 1870. The first source of supply was Breed's Pond, which, when full, has 22 feet of water at the dam. It contains 54.85 acres of water surface, a total storage capacity of 262,563,340 gallons, a water-shed, including pond surface, of .96 square miles.

Birch Pond has a depth of 21.50 feet of water at dam, and a pond surface of 82 acres, with a water-shed area, including the pond, of .79 of a square mile, a total storage capacity of 381,062,901 gallons.

In 1886 a pumping station was erected at the upper end of Birch Pond over the canal, equipped with a steam-engine and boiler of 60-horse power, and a Webster 15-inch centrifugal pump capable of pumping 12,000,000 gallons of water daily from the canal into the pond. This became necessary in order to fill Birch and Breed's Ponds when they were unable to fill from their own water-shed.

Walden Pond, when full, has 17 feet of water at dam, a pond surface of 128 acres, and a water-shed, including pond surface, of 1.31 square miles, a storage capacity of 403,163,826 gallons.

.

Glen Lewis Pond has a depth of 17 feet, with a pond surface of 36 acres, a water-shed, including pond surface, of .36 square miles, and a storage capacity of 120,475,126 gallons.

Hawkes Pond has a depth of 25 feet, with a pond surface of 75 acres, a water-shed, including pond surface, of 1.92 square miles, and a storage capacity of 300,000,000 gallons. This total area of 5.18 square miles of water-shed has a total storage area of 1,467,265,193 gallons.

In the general development of our present water supply a conduit has been constructed from Saugus River to Hawkes Pond, commencing at the river, from a point just above the railroad at Montrose, and running to the upper end of Hawkes Pond. This conduit consists of 2,430 feet of open canal, 220 feet concrete conduit, 200 feet stone culvert and 730 feet tunnel, having a capacity for delivering 30,000,000 gallons of water daily from Saugus River to Hawkes Pond.

The water-shed from which the city has a right to take water which contributes to this supply, contains less than 50 inhabitants to the square mile, and is entirely free from all direct sewage contamination.

To improve the quality of the water from this area, the entire bed of the Saugus River has been lowered and thoroughly cleaned of all obstructions that might serve to impede the flow or injure the character of the water. The work of draining all swamps within the water-shed was commenced in 1898 and will be continued to its completion. A marked improvement is shown in the quality of water in the area where the drainage work is completed.

The importance of an abundant supply of water has been fully explained in the special report presented to your honorable body February 5, 1901.

Since the publication of this report there has been many questions and some criticisms, both public and private, upon the advisability of this plan. Notwithstanding this, the report expressed the unanimous opinion of the Public Water Board in relation to securing an additional storage capacity by raising Walden Pond dam twenty (20) feet above its present height.

We submitted therewith a report of Lucian A. Taylor, hydraulic engineer, with estimated cost of increased storage capacity. We also recommended that the City Council petition the Legislature for the right to borrow the sum of \$400,000, a sufficient amount to meet the demands for constructing the same. If the recommendation of the Water Board has the approval of the City Council, and authority granted, the work of construction could be completed in 1902.

In Mr. Taylor's report, he says, "this additional storage will be sufficient to last the city of Lynn about seventeen (17) years."

We would further recommend in this report that the city should not wait until the limit of our present supply is exhausted before petitioning for an extension of the works, but recommend an early application to the Legislature for the right to take the waters of Ipswich River and its tributaries, with a water-shed of twenty-seven (27) square miles of territory, which would furnish the city with an abundance of water. This water-shed contains a population of less than fifty (50) inhabitants to the square mile.

Notwithstanding the extra expenditure, the demand seems imperative to properly maintain the care of the works, and with the continued growth of our city it is the part of prudence to be equal to any emergency.

Our water supply is now considered among the best in the State. For several years the Water Board have caused a thorough inspection of the water-shed, and with the aid of our Superintendent have continued to watch with care all sources of contamination of the water, eliminating them as far as possible. The condition of the water shows, that little, if any, organic matter is now present, and while constant vigilance in that direction is necessary, and always will be, we have reason to be congratulated upon the generally clean and wholesome condition of the water-shed.

The following statement will show the work done by the department the past year :

A large 30-inch main has been laid from the pumping station to Birch Pond gate-house, a distance of 6,250 feet. The pipe is connected with a combination gate chamber within the gate-

house, designed by Engineer A. J. L. Loretz, which proves to be of valuable service in supplying the pump. The pipe at the pumping station has been connected directly with the pump, under the direction of Engineer Loretz, which reduces the cost of pumping from 10 to 15 per cent.

Before laying the new main water was taken from Birch Pond and the canal through a 22-inch pipe, the size of which was not sufficient to supply the pump, consequently we were obliged to draw a portion from Breed's Pond.

With the 30-inch main we can draw a full supply from Birch Pond, or the canal, and not be obliged to draw from Breed's Pond only when needed.

The receipts from water rates exceed those of any previous year. A thorough house to house inspection has been carried on throughout the year. Buildings metered and unmetered have been inspected. All leaks and new fixtures have been reported, thereby reducing the waste and increasing the receipts.

We present the report of Lucian A. Taylor, C. E.

Public Water Board, Lynn, Mass. :

GENTLEMEN, — In accordance with your instructions of Oct. 30th, last, I have made studies and estimates for an additional storage basin for the Lynn Water Works.

The subject is one of considerable magnitude, and has required a great amount of thought and study, and various estimates of a number of schemes and projects.

It seems advisable to develop the storage capacity of the location of Walden and Glen Lewis Ponds by raising the present dam. Surveys and estimates have been made to develop the storage basin of Waldon Pond to about its ultimate capacity. This has resulted in preparing estimates to raise the present dam 40 feet, and increasing the depth of water in the reservoir from 17 to 57 feet. The area of the reservoir will be increased from 164 to 331 acres, and the capacity from 523,639,000 to 3,591,682,000 gallons. The area will be almost exactly doubled, while the capacity is increased to seven times the present amount. The average depth of water will be 33.2 feet.

The raising of the main dam 40 feet also necessitates the building of a dam 400 feet in length at the head of Glen Lewis Pond, and three smaller dams along the Newburyport turnpike. Estimates have been made for all these dams; also for the clearing of the basin to an elevation of at least two feet above high water mark. The surveys show the basin to be a remarkably good one in all respects for the storage of water, the sides of the reservoir being very steep, and no shallow flowage in any part. The average slopes of the sides of the basin are about 20 feet per 100, in many places as high as 50 feet per 100. This will be clearly seen by examining the accompanying table of capacities and area. The entire additional area to be flowed is covered with a small growth of wood, except the roadway along the valley, and it is, with the exception of very light soil, one mass of rock and boulders. There are no inhabitants within the entire radius of the water-shed.

To raise the dam 40 feet will increase the storage capacity of the reservoir 3,068,043,000 gallons. This is an average of a little more than 8,400,000 gallons per day additional storage. It would seem unnecessary to provide for so great an increase of storage capacity at the present time, and I have made plans and estimates for raising the dam 20 feet.

This will increase the area of the reservoir 240 acres, or 76 acres more than the present one, and the capacity to 1,754,157,078 gallons, an increase of 1,230,518,078 gallons. This increased storage equals a daily supply of a little more than 3,335,000 gallons. The area of the reservoir is increased $46\frac{3}{10}$ per cent., while the storage capacity is increased $232\frac{1}{2}$ per cent. The average depth of water will be 22.6 feet.

This additional storage will be sufficient to last the city of Lynn about seventeen years. At the end of that time, 20 feet additional can be added to the dam at a moderate expense, and its capacity increased by 1,850,744,000 gallons, and the area of the reservoir from 240 to 331 acres, an increase of 91 acres. This will give an additional supply of 5,070,000 gallons per day.

The estimated expense of raising the present dam at Walden Pond 20 feet, with foundations of gate chamber and core wall of of sufficient strength to raise the dam to an ultimate height of 40

feet, including the clearing and cleaning of the present ponds and the stripping of the additional area flowed, is \$359,015.00. In this no estimate is made for the pumping station at Hawkes Pond, which would be necessary. The estimated cost of the conduit, pumping station and pumps, complete, is fifty thousand dollars (\$50,000.00). As raised 20 feet, high water in Walden Pond will be 16 feet, 9 inches above high water in Hawkes Pond.

The estimated expense of raising the dam the full height of 40 feet, including a dam at the head of Glen Lewis Pond, and three dams along the line of the Newburyport turnpike, clearing and grubbing the present pond and stripping of the additional area flowed, is \$622,511.00.

The cost of the dam and basin for storing 1,000,000 gallons with the dam raised 20 feet, will be \$295,—the cost with the dam raised the full height of 40 feet, will be \$203. The increased cost in the first instance, of course, being due to the great expense of heavy foundations suitable for a dam 40 feet in height. The cost of storing the upper 20 feet will only be \$150 per million gallons. The following are the area capacity and cost of construction of dams and reservoirs, actual or estimated, at the various places :

	Area, Acres.	Capacity in Million Gallons.	Cost per Million Gallons.
Walden Pond Basin	331	3,591,000,000	\$203 00 (est)
Boston Water Works, Basin No. 1,	143	280,000,000	918 00
Boston Water Works, Basin No. 2,	134	530,000,000	879 00
Boston Water Works, Basin No. 3,	253	1,080,000,000	388 00
Boston Water Works, Basin No. 4,	167	1,400,000,000	581 00
Boston Water Works, Basin No. 6,	185	1,350,000,000	590 00
City of Camb'ge, Hobbs Br'k Basin,	653	1,530,000,000	634 00
Worcester, Dam No. 1	72	500,000,000	478 00 (est)
Worcester, Dam No. 2			746 00 (est)
Worcester, Dam No. 3			1,043 00 (est)

It will be seen that even the storage of the first 20 feet of water makes a very favorable showing, being considerably less than any of the reservoirs just mentioned. In the estimates, as stated, I have allowed for the cleaning of the entire basin. In a small portion of Glen Lewis and Walden Ponds, the mud will be left

in place and covered with gravel instead of being excavated and carried away. I believe the estimates are liberal, and that the work can be accomplished for the amounts stated.

The following table gives the area and capacity of the present reservoir, and also the area and capacity for each additional five feet in height.

Elevation.	Area, Acres.	Capacity, Gallons.
65.50	164	523,638,950
70.50	178	731,906,000
75.50	196	1,037,055,000
80.50	216	1,373,056,000
85.50	240	1,754,157,080
90.50	269	2,145,303,000
95.50	284	2,589,176,000
100.50	307	3,071,469,000
105.50	331	3,591,682,000

The above table, as well as the surveys of the entire basin, have been made by Mr. E. F. Dwelley, in a most thorough and satisfactory manner. The accompanying plans show the sections and profiles of the several dams as proposed, and also some studies in connection with the main or principal dam.

Basing my judgment upon the above facts and figures, I recommend the raising of the present Walden Pond dam, 20 feet, with foundation and core wall of sufficient strength to eventually raise the dam 20 feet more.

In concluding, will say I know of no reservoir of similar size and character so good for the storage of water as the proposed basin or that can be constructed with so small an expense per million gallons, or where the average depth of water is so great compared with the area. I also believe storage in this deep basin will greatly improve the quality of the water stored.

Respectfully submitted,

LUCIAN A. TAYLOR,
Consulting Engineer.

BOSTON, May 7, 1900.

Biological.

Weekly biological examinations have been made of all the sources, and from the tap at City Hall, showing the water to be of good quality. A table showing the results will be found appended.

Mains.

During the year cement-lined pipes have been relaid with cast-iron in the following streets :

Broadway, Chestnut, Essex, Ireson, Myrtle, Nelson, Summer.

Water Supply for Fire Purposes.

The city is exceptionally well provided with a water supply for fire purposes. One million gallons per hour can be delivered in the business part of the city if necessary.

Land Purchased in 1900.

Albert and Andrew Mansfield	9.53 acres.
Estate W. N. Bryant	4 37 acres.

Statement.**WATER DEBT.**

Amount of debt, December 20, 1899	\$1,810,300 00	
Bonds issued in 1900	50,000 00	
	<hr/>	\$1,860,300 00
Bonds paid in 1900		60,000 00
		<hr/>
Amount of Debt, December 20, 1900		\$1,800,300 00

SINKING FUNDS.

Amount of funds, December 20, 1899	\$449,053 65	
Received from Treasurer, 1900	44,006 13	
Income from investments in 1900	18,638 60	
	<hr/>	\$511,718 48
Deduct amount paid on bonds in 1900	60,000 00	
	<hr/>	
Amount in hands of Commissioners, December 20, 1900	\$451,718 48	
Balance in hands of Treasurer, December 20, 1900	72,309 02	
	<hr/>	\$524,027 50
Net water debt		\$1,276,272 50

Treasurer's Statement for the Year Ending Dec. 20, 1900.

RECEIPTS.

From water rates	\$199,992 17	
From premiums on loans	8,686 42	
From accrued interest on bonds sold	<u>144 44</u>	\$208,823 03

EXPENDITURES.

For maintenance	\$62,717 77	
For interest	<u>73,796 24</u>	136,514 01
Net income		<u>\$72,309 02</u>

Respectfully submitted,

WILLIAM B. LITTLEFIELD.

President.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
Lynn, Mass., January 1, 1901. }

To William B. Littlefield, President:

SIR,—I herewith present the financial condition of the department for the year ending December 31, 1900.

RECEIPTS FOR 1900.

Fixture rates	\$118,481 42	
Meter rates	73,558 75	
Miscellaneous	5,152 84	
Additional rates	2,124 32	
Fines	55 55	
Total revenue	—	\$199,372 88
Extra pipe		3,466 41
		\$202,839 29
Total receipts as per cash book		

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$199,372 88	
Amount outstanding, fixture rates	\$15,595 74	
Amount outstanding, meter rates	6,785 56	
Amount outstanding (not due) meter rates	16,731 43	
	39,112 73	
	\$238,485 61	
Deduct amount due January 1, 1900	39,482 07	
	\$199,003 54	
Revenue for 1900	193,699 01	
Revenue for 1899		
Increase	\$5,304 53	

STATEMENT OF NET EARNINGS FOR 1900.

Revenue	\$199,003 54
EXPENSES.	
Interest	\$73,796 24
Maintenance	61,566 01
Rebate to Saugus	1,932 20
	<hr/>
	137,294 45
Net earnings	\$61,709 09

EXPENDITURES FOR THE YEAR 1900.

MAINTENANCE	
Pumping, expenses	\$12,017 91
Salaries and office expenses	9,100 30
Mains	8,197 45
Services	6,839 96
Meters	5,448 27
Engines and boilers	3,729 29
Stable and shop	3,656 90
Damages	2,829 98
Legal expenses	2,339 36
Birch Pond	1,859 70
Canal	1,635 89
Pumping (Birch Pond)	789 49
Walden Pond	778 71
Engine house	714 11
Breed's Pond	459 25
Hawkes Pond	456 54
Hawkes Pond conduit	193 36
Stand-pipe	175 75
Incidental, (50th anniversary)	170 36
Laboratory	116 93
Reservoir	56 50
	<hr/>
	\$61,566 01
CONSTRUCTION.	
Conduit (30 inches)	\$31,805 91
Mains	7,346 71
Services	6,611 49
Hawkes Pond	1,725 94
Engineering, (Walden Pond)	1,236 78
	<hr/>
	\$48,726 83
Less amount received for extra pipe	3,466 41
	<hr/>
Net	\$45,260 42

STATEMENT.

SHOWING COST OF WORKS TO JANUARY 1, 1901.

Mains, hydrants and gates	\$877,260 26
New supply and land	337,390 75
Services and courts	305,872 24
Walden and Glen Lewis Ponds	185,179 42
Engines and boilers	140,327 29
Hawkes' Pond	161,036 53
Reservoirs and land	131,581 49
Birch Pond and land	93,471 84
Engine house and land	57,562 39
Breed's Pond and land	57,135 28
Pipe conduits and land	77,099 89
Hawkes Pond canal	43,836 65
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,274 07
Highland service	12,431 17
Engineering	10,482 95
Tubular wells	9,470 02
Work shop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,616,061 76
Less amount received for pipe	143,239 91
	<hr/>
Total net cost	\$2,472,821 85

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,634	
Number of services in Saugus	935	
Total	<u> </u>	12,569
Number put in during the year (Lynn)	120	
Number put in during the year (Saugus)	43	
Total	<u> </u>	163
Number extended during the year (Lynn)	20	
Number extended during the year (Saugus)	1	
Total	<u> </u>	21
Renewed	75	
Number discontinued	15	
Number not in use	73	
Turned on (new services)	76	
Turned on (reoccupied)	123	
Turned on (repairs)	68	
Shut off (for vacancy)	258	
Shut off (for non-payment)	28	
Shut off (for repairs)	131	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
 ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
 CONTAINED IN THE SAME, TOGETHER WITH THE
 NUMBER OF FIRE HYDRANTS, DEC. 31, 1900.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	11,675	875	12,550
Stores and shops	1,210	44	1,254
Factories	190	2	192
Offices	475	15	490
Restaurants and saloons	81	..	81
School-houses	54	7	61
Churches	31	5	36
Bakeries	32	..	32
Laundries	20	..	20
Engine houses	11	3	14
Families	16,189	960	17,149
Boarding-houses	221	2	223
Faucets	30,649	1,725	32,374
Water-closets	13,718	420	14,138
Bath tubs	5,341	331	5,672
Hose bibs	3,180	154	3,334
Urinals	189	8	197
Heaters	875	60	935
Stationary engines	157	6	163
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	29	..	29
Stand-pipes for fire purposes	16	1	17
Stand-pipes for water-carts	74	..	74
Sewer connections	24	..	24
Automatic sprinklers	92	2	94
Hydrants	801	151	952
Hydrants for car sprinklers	38	..	38

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	.	.	.	\$8,989	00
From January 1, 1872, to January 1, 1873	.	.	.	27,568	15
From January 1, 1873, to January 1, 1874	.	.	.	47,992	61
From January 1, 1874, to January 1, 1875	.	.	.	53,545	61
From January 1, 1875, to January 1, 1876	.	.	.	52,553	26
From January 1, 1876, to January 1, 1877	.	.	.	60,807	12
From January 1, 1877, to January 1, 1878	.	.	.	64,002	50
From January 1, 1878, to January 1, 1879	.	.	.	67,570	14
From January 1, 1879, to January 1, 1880	.	.	.	73,949	80
From January 1, 1880, to January 1, 1881	.	.	.	79,635	12
From January 1, 1881, to January 1, 1882	.	.	.	80,967	76
From January 1, 1882, to January 1, 1883	.	.	.	94,419	52
From January 1, 1883, to January 1, 1884	.	.	.	98,993	54
From January 1, 1884, to January 1, 1885	.	.	.	114,903	86
From January 1, 1885, to January 1, 1886	.	.	.	110,089	11
From January 1, 1886, to January 1, 1887	.	.	.	116,375	70
From January 1, 1887, to January 1, 1888	.	.	.	123,507	73
From January 1, 1888, to January 1, 1889	.	.	.	134,480	27
From January 1, 1889, to January 1, 1890	.	.	.	141,865	53
From January 1, 1890, to January 1, 1891	.	.	.	154,788	27
From January 1, 1891, to January 1, 1892	.	.	.	171,744	85
From January 1, 1892, to January 1, 1893	.	.	.	188,979	88
From January 1, 1893, to January 1, 1894	.	.	.	177,803	56
From January 1, 1894, to January 1, 1895	.	.	.	176,655	50
From January 1, 1895, to January 1, 1896	.	.	.	185,572	88
From January 1, 1896, to January 1, 1897	.	.	.	190,531	33
From January 1, 1897, to January 1, 1898	.	.	.	183,711	97
From January 1, 1898, to January 1, 1899	.	.	.	186,658	35
From January 1, 1899, to January 1, 1900	.	.	.	193,699	01
From January 1, 1900, to January 1, 1901	.	.	.	199,003	54
				\$3,561,325	48

FUNDED WATER LOAN.

When Payable.	Rate. Per Cent.	Amount.
Mar. 1, 1903	4	8,000
May 1, 1904	3½	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3½	66,500
Dec. 1, 1905	3½	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3½	31,000
Mar. 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3½	6,000
Apr. 1, 1916	3½	2,000
May 1, 1916	3½	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3½	6,500
June 1, 1917	3½	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
July 1, 1925	4	165,000
July 1, 1926	4	50,000
Sept. 1, 1927	4	25,000
July 1, 1928	4	25,000
Oct. 1, 1928		10,000
July 1, 1929		25,000
Jan. 1, 1930		25,000
Oct. 1, 1930		25,000
Note (on demand)	4	100,000
		<hr/>
		\$1,800,300

REPORT OF SUPERINTENDENT.

To Wm. B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1900.

Water Supply.

The supply for the year was taken from the following sources :

Hawkes and Walden Ponds, 783,716,658 gallons; Birch Pond, 534,326,871 gallons; Breed's Pond, 391,524,021 gallons; a total of 1,709,567,550 gallons.

On November 1, 1899, Breed's Pond contained 103,579,220; Birch Pond, 58,114,116; Walden Pond, 25,330,000; Glen Lewis Pond, 100,123,814; Hawkes Pond, 60,668,720; a total of 347,815,870 gallons above a plane of six feet.

On November 1, 1900, Breed's Pond contained 144,136,103; Birch Pond was drawn off in order to lay the 30-inch conduit through the dam; Hawkes Pond, 114,817,303; Walden Pond, 74,992,226; Glen Lewis Pond, 85,819,807; a total of 419,765,479 gallons above a plane of six feet, below which level the water is unfit for use.

The city has been favored with exceptionally good water throughout the year.

Canal.

The canal has been cleaned its entire length and repaired in several places where leaks were discovered.

Pumping Station.

A new high pressure cylinder has been set to replace the old one, which had a shrinkage crack on the side of the Loretz engine. The lagging on the Leavitt engine has been repaired.

New Conduit.

A new 30-inch conduit 6,250 long has been laid from Birch Pond gate chamber to the Pumping Station, to be connected directly with the pump, thereby increasing the pumpage, and reducing the expense overdrawing from the well chamber. This has been done under the direction of Mr. A. J. L. Loretz, hydraulic engineer, who built our Loretz engine.

Pumping Station.

The grounds back of the pumping station have been graded and drains laid to carry off the water. The roof of the storage house has been raised and repaired.

Bridges.

Two new bridges have been rebuilt, one at Birch Pond gate-house, and the other at the reservoir. The stand-pipe, all the gate-houses and bridges have been painted, and the stable at the City Hall.

Mains Relaid.

During the year 7,227 feet of cement-lined pipe have been replaced with cast-iron in the following streets:

Chestnut, from Maple to Broadway; Broadway to Lynnfield; Essex, from Fayette to Chatham; Ireson; Myrtle, from Holyoke to railroad station; Nelson, Western avenue to Hood; Allen, Western avenue to Hood; Summer, Elm to South; Ocean avenue from Wave to Ocean place. Extensions have been laid in Atkins avenue, Clark, Intervale, Locust, Quebec, Rhodes, Sewall and Williams streets.

During the year 10 gates have been set in connection with the new mains; one new gate replaced the old; 18 street sprinkler hydrants were repaired; 3 fire hydrants and 33 hydrant leaks were repaired; 7 new hydrants replaced the old and 3 new were added; 16 main gate boxes were raised where streets were graded; 45 feet of ledge was excavated in trenching; 163 services were put in; 30 were extended; 4 were discontinued, 91 were renewed; 53 services were changed from the old to the new main; one was lowered; 47 service boxes were changed where streets were graded; 1,667 services were bushed out; 162 lead

pipes were renewed; 145 stop-boxes were reset; 267 leaks in service pipe repaired; 39 stop-and-wastes were renewed; 17 private hydrants, 10 drinking fountains were repaired; 275 meters were set and 41 changed; 15 outside meter boxes were renewed; 7 new boxes put in; 228 meters repaired.

The following tables show the work performed by the department during the year.

Respectfully submitted,

D. A. SUTHERLAND,

Superintendent.

Microscopical Examination of Water from Birch Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 9.	June 13.	July 12.	August 16.	September 13.	October 10.
Number of Sample	29886	30175	30464	30952	31190	31535	31982	32492	32806	33239
Plants.										
DIATOMACEÆ:	31	6	5	217	926	1011	65	204	104	138
Asterionella	5	1	0	6	546	20	1	80	0	5
Cyclotella	0	0	0	0	2	59	2	0	2	0
Synedra	26	1	3	206	336	0	0	0	0	2
Tabellaria	0	4	0	5	30	932	62	124	102	128
CYANOPHYCÆ:	0	0	0	0	0	1	5	355	25	21
Anabæna	0	0	0	0	0	1	1	18	0	0
Aphanocapsa	0	0	0	0	0	0	2	340	0	0
Merismopedia	0	0	0	0	0	0	2	0	16	0
Microcystis	0	0	0	0	0	0	0	0	0	21
ALGÆ:	1	0	0	21	42	53	273	282	58	12
Arthrodesmus	0	0	0	0	24	3	7	104	10	10
Protococcus	0	0	0	21	16	43	261	80	60	0
Animals.										
INFUSORIA:	17	127	126	502	14	1	8	10	20	5
Dinobryon	12	101	85	500	9	0	8	0	16	5
Peridinium	1	21	36	0	0	0	0	0	0	0
VERNES:	1	0	0	1	0	2	1	0	0	0
MISCELLANEOUS:										
Zooglaea	3	3	8	8	8	3	3	8	8	5
Total	53	136	139	749	960	1071	355	862	245	181

Microscopical Examination of Water from Breed's Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 9.	June 13.	July 12.	August 16.	September 12.	October 10.	November 13.	December 12.
Number of Sample . .	29887	30176	30465	30953	31191	31536	31983	32493	32888	33240	33635	34021
Plants.												
DIATOMACEÆ:	10	67	26	55	87	403	42	19	25	9	69	73
Asterionella	2	26	18	20	28	3	8	12	9	8	41	54
Cyclotella	1	3	1	0	3	142	1	0	0	0	9	1
Tabellaria	2	37	3	30	56	258	33	7	14	1	10	3
CYANOPHYCÆ,	0	0	0	0	0	0	12	2	0	1	0	0
Anabæna	0	0	0	0	0	0	11	0	0	0	0	0
ALGÆ:	0	0	0	0	7	0	6	4	10	2	2	2
Animals.												
INFUSORIA:	39	37	2	29	28	5	3	9	3	2	10	67
Dinobryon	33	22	2	29	21	0	1	1	0	2	8	35
Uroglena	0	0	0	0	0	1	0	0	0	0	2	29
VERMES:	4	0	0	0	0	2	1	3	0	4	0	2
CRUSTACEA: Cyclops,	0	0	0	0	0	0	0	0	0	pr.	0	0
MISCELLANEOUS:												
Zooglaea	3	5	5	3	3	3	3	3	3	3	5	5
Total	56	109	33	87	125	413	67	40	41	21	95	149

Microscopical Examination of Water from Glen Lewis Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 9.	June 13.	July 12.	August 16.	September 12.	October 10.	November 13.	December 12.
Number of Sample . .	29688	30177	30466	30954	31102	31537	31984	32494	32889	33241	33636	34022
Plants.												
DIATOMACEÆ:	740	336	12	104	638	162	590	302	279	290	440	71
Asterionella	16	0	0	4	52	0	12	12	0	28	212	50
Melosira	0	0	0	18	342	162	570	260	275	254	222	19
Synedra	724	332	12	81	214	0	8	2	2	6	4	2
CYANOPHYCÆ:	0	0	0	0	16	62	100	1746	450	280	24	2
Anabæna	0	0	0	0	4	0	0	1376	245	144	0	0
Clathrocystis	0	0	0	0	12	62	100	368	204	136	24	2
Cœlosphærium	0	0	0	0	0	0	0	10	10	0	0	0
ALGÆ:	1	4	4	26	314	34	8	14	0	4	46	1
Scenedesmus	0	0	0	0	308	0	0	0	0	0	0	0
Animals.												
INFUSORIA:	12	852	640	201	12	6	20	14	8	22	41	75
Dinobryon	0	100	588	180	0	0	0	0	0	0	32	35
Euglena	3	664	12	7	0	0	4	12	0	0	2	6
Peridinium	7	44	28	7	12	0	0	0	0	0	0	34
Trachelomonas	0	0	0	0	0	0	16	0	8	22	8	0
Uroglena	0	44	4	4	0	0	0	0	0	0	2	0
VERMES:	0	4	0	0	4	4	0	0	2	0	0	2
CRUSTACEA:	0	0	0	0	0	pr.	0	0	pr.	0	0	0
Cyclops	0	0	0	0	0	pr.	0	0	0	0	0	0
Daphnia	0	0	0	0	0	0	0	0	pr.	0	0	0
MISCELLANEOUS:												
Zoogloea	3	0	10	7	20	10	10	20	10	10	14	5
Total	756	1196	666	338	1004	278	728	2056	753	606	568	174

Microscopical Examination of Water from Hawkes Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 9.	June 13.	July 12.	August 16.	September 13.	October 10.	November 13.	December 12.
Number of Sample . .	29839	30178	30467	30955	31193	31538	31985	32495	32838	33242	33637	34023
Plants.												
DIATOMACEÆ:	13	2	2	84	536	92	387	78	39	319	447	506
Asterionella	3	0	0	0	0	0	202	0	8	267	264	142
Cyclotella	0	0	0	0	0	0	0	0	7	21	181	362
Synedra	9	2	2	78	504	0	4	0	1	1	2	1
Tabellaria	0	0	0	6	32	92	180	78	23	29	0	0
CYANOPHYCÆ:	0	0	0	0	0	0	0	4	0	3	0	0
ALGÆ:	0	0	0	0	4	10	23	4	71	20	3	0
Protococcus	0	0	0	0	0	0	16	0	69	16	0	0
Animals.												
INFUSORIA:	25	148	131	219	144	1	0	20	4	59	1007	292
Dinobryon	22	84	47	202	0	0	0	0	0	56	1004	292
Mallomonas	1	0	0	0	0	0	0	10	0	1	1	0
Peridinium	2	58	84	0	0	1	0	2	0	1	0	0
Uroglena	0	2	0	13	144	0	0	0	0	0	0	0
VERMES:	0	0	0	0	0	0	1	1	0	1	0	0
CRUSTACEA:												
Cyclops	0	0	0	0	0	0	0	0	0	0	pr.	pr.
MISCELLANEOUS,												
Zoogloea	3	8	5	12	10	5	3	3	3	5	7	5
Total	41	158	138	315	694	108	414	110	117	407	1464	803

Microscopical Examination of Water from Howlett's Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 10.	June 13.	July 12.	August 16.	September 13.	October 10.	November 14.	December 12.
Number of Sample . .	29800	30179	30468	30956	31194	31539	31986	32406	32897	33243	33638	34024
Plants.												
DIATOMACEÆ:	3	63	30	13	20	5	2	5	132	38	3	15
Cyclotella	0	1	0	0	1	0	2	0	124	32	0	5
ALGÆ:	0	0	0	0	1	3	3	13	522	3	1	0
Protococcus	0	0	0	0	0	0	0	12	500	0	0	0
FUNGI, Crenothrix . .	0	0	0	0	0	0	74	0	0	0	0	0
Animals.												
INFUSORIA:	0	59	204	5	4	2	19	2	24	30	0	7
Dinobryon	0	54	186	7	2	0	0	0	0	6	0	6
Euglena	0	0	0	0	0	0	0	0	2	15	0	0
Peridinium	0	2	4	1	0	0	5	1	11	1	0	0
Synura	0	1	14	0	0	0	0	0	0	7	0	0
Trachelomonas	0	0	0	0	0	0	13	1	9	1	0	0
RHIZOPODA, Actinophrys	0	0	0	0	0	0	0	0	0	1	0	0
CRUSTACEA:	0	0	0	0	0	0	0	0	0	pr.	0	0
Cyclops	0	0	0	0	0	0	0	0	0	.02	0	0
Daphnia	0	0	0	0	0	0	0	0	0	.02	0	0
MISCELLANEOUS:												
Zoogloea	5	5	3	3	3	25	15	3	7	5	3	3
Total	8	127	237	24	37	35	113	23	685	77	7	25

Microscopical Examination of Water from Walden Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 10.	June 13.	July 12.	August 16.	September 12.	October 10.	November 14.	December 12.
Number of Sample . .	29891	30180	30470	30957	31196	31540	31987	32497	32890	33245	33639	34025
Plants.												
DIATOMACEÆ:	11	100	307	1151	581	124	1258	388	991	408	1856	135
Asterionella	0	4	0	4	36	24	984	41	0	20	972	78
Melosira	0	0	0	0	58	12	42	38	286	90	452	21
Synedra	11	178	204	1140	486	50	4	4	7	238	76	13
Tabellaria	0	13	13	7	1	38	226	304	698	60	346	21
CYANOPHYCEÆ:	0	0	0	0	0	1	0	3	4	2	16	0
Aphanocapsa	0	0	0	0	0	0	0	0	0	1	14	0
ALGÆ:	0	0	0	15	5	10	4	26	50	11	30	13
Animals.												
INFUSORIA:	12	90	65	277	420	7	96	13	40	374	18	30
Dinobryon	0	36	40	261	420	0	92	0	0	0	0	0
Monas	0	0	0	0	0	0	0	0	0	0	10	0
Peridinium	9	43	18	12	0	1	4	2	18	374	0	28
Trachelomonas	0	0	0	0	0	3	0	6	18	0	2	2
Uroglena	0	1	1	1	0	0	0	0	0	0	2	0
VERMES:	1	7	1	1	0	2	0	1	0	0	8	0
CRUSTACEA:	0	0	0	0	0	0	pr.	pr.	0	0	2	0
MISCELLANEOUS:												
Zooglaea	5	5	5	7	7	5	5	10	8	5	10	5
Total	29	301	378	1451	1013	158	1363	441	1293	800	1940	183

Microscopical Examination of Water from Saugus River at Montrose.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 10.	June 13.	July 12.	August 16.	September 13.	October 10.	November 14.	December 12.
Number of Sample . .	29892	30181	30469	30058	31195	31541	31988	32498	32899	33244	33640	34026
Plants.												
DIATOMACEÆ:	6	3	69	57	29	117	12	4	0	0	25	10
Synedra	2	3	64	48	19	14	4	0	0	0	4	2
Tabellaria	2	0	0	2	3	55	5	2	0	0	13	0
CYANOPHYCEÆ:	0	0	0	0	0	0	1	0	0	0	0	0
ALGÆ:	0	0	35	0	2	4	68	223	24	0	5	0
Protococcus	0	0	35	0	0	0	67	222	0	0	0	0
Animals.												
INFUSORIA:	23	132	206	66	5	0	0	5	1	6	1	0
Dinobryon	19	127	197	63	0	0	0	0	0	0	0	1
VERMES:	0	1	0	0	0	0	0	0	0	0	1	1
Anurea	0	1	0	0	0	0	0	0	0	0	0	0
Polyarthra	0	0	0	0	0	0	0	0	0	0	1	1
MISCELLANEOUS, Zoogloea	5	5	5	5	3	5	5	8	3	3	3	5
Total	34	141	315	128	39	126	86	240	28	9	35	16

Microscopical Examination of Water from a Faucet in Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1900.	January 10.	February 14.	March 15.	April 11.	May 10.	June 19.	July 12.	August 16.	September 13.	October 10.	November 14.	December 12.
Number of Sample . .	20893	30182	30471	30959	31197	31717	31989	32199	32891	33246	33641	34027
Plants.												
DIATOMACEÆ:	22	9	4	319	221	107	56	10	51	114	753	143
Asterionella	3	6	4	0	29	4	2	0	0	6	260	68
Melosira	0	0	0	0	6	24	0	0	12	49	348	17
Synedra	17	2	0	302	169	0	2	0	0	4	48	9
Tabellaria	2	0	0	17	16	77	51	10	38	55	97	41
CYANOPHYCÆ:	0	0	0	0	0	0	2	6	8	0	10	2
Aphanocapsa	0	0	0	0	0	0	0	5	0	0	10	0
ALGÆ:	0	0	0	0	6	2	78	19	54	3	18	1
Protococcus	0	0	0	0	0	0	70	8	51	0	0	0
Animals.												
INFUSORIA:	1	34	12	146	38	0	2	0	1	0	8	1
Dinobryon	0	25	8	144	38	0	0	0	0	0	7	0
VERMES:	0	0	0	1	1	0	0	0	0	1	3	0
MISCELLANEOUS, Zoogloea	3	3	3	5	5	7	5	3	3	3	3	5
Total	26	46	19	471	271	116	143	38	117	121	795	152

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1900.

MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	140,608,454	4,535,756	. . . . .	520,196	61.62	62.85
February	127,104,723	4,539,455	. . . . .	731,254	61.68	62.91
March	134,359,996	4,334,193	. . . . .	531,569	58.89	60.07
April	122,658,469	4,088,615	. . . . .	629,343	55.55	56.66
May	133,206,875	4,296,996	. . . . .	908,004	58.38	59.55
June	153,837,881	5,127,929	. . . . .	1,231,910	69.67	71.06
July	173,057,598	5,582,503	. . . . .	1,021,010	75.85	77.37
August	164,026,282	5,291,173	. . . . .	1,200,334	71.89	73.33
September	157,759,937	5,258,665	. . . . .	857,530	71.45	72.88
October	137,923,856	4,449,156	. . . . .	639,709	60.45	61.66
November	128,465,445	4,282,182	. . . . .	163,129	58.18	59.34
December	135,143,554	4,359,470	38,940	. . . . .	59.23	60.41
Totals and averages	1,708,153,070	4,679,871	. . . . .	699,099	63.58	64.85

Basis: Population, Lynn and Saugus, 73,600.

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1900.

MONTH.	GALLONS.			
	Breed's.	Birch.	Canal.	Total.
January	2,111,900	138,791,835	. . . . .	140,903,735
February	29,375,500	30,087,225	65,511,775	124,974,500
March	105,703,495	. . . . .	33,990,595	139,694,090
April	9,469,744	. . . . .	108,658,861	117,128,605
May	52,389,332	18,142,548	62,479,490	133,011,370
June	38,231,025	33,052,950	86,692,025	157,976,000
July	23,916,900	124,749,100	21,033,250	169,699,250
August	4,675,825	72,774,800	87,054,625	164,505,250
September . . . . .	. . . . .	18,515,875	142,877,875	161,393,750
October	720,913	92,458,712	44,449,125	137,628,750
November	77,043,925	293,388	50,368,937	127,706,250
December	48,885,462	5,460,438	80,600,100	134,946,000
Totals	391,524,021	534,326,871	783,716,658	1,709,567,550

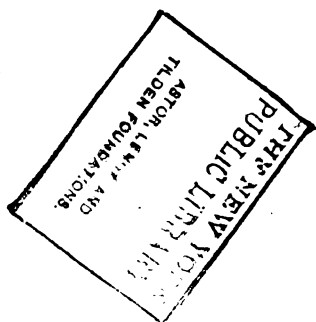
TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1900.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	0.71	.	1.05	.	.	.	.	.	.	0.01	.	.
2	.	.	.	0.23	0.63	0.05	.	.	.	.	.	.
3	.	.	.	0.13	1.05	0.25	0.04	.	.	.	.	.
4	.	0.65	0.03	.	.	.	.	.	.	.	.	.
5	.	0.02	0.10	.	.	.	0.02	.	.	.	.	0.05
6	.	.	0.35	.	.	.	0.10	0.17	.	0.01	.	.
7	0.07	.	.	.	.	.	.	0.16	.	.	0.03	.
8	.	0.60	.	.	0.15	0.07	.	.	.	0.65	0.21	.
9	.	0.17	.	.	0.17	.	.	.	.	0.17	0.20	.
10	0.01	0.03	.	.	.	.	.	0.08	.	0.15	.	.
11	1.25	.	.	.	.	.	.	.	.	0.34	0.05	0.21
12	.	1.00	.	0.44	.	.	0.35	.	.	.	.	.
13	0.08	0.20	.	0.03	.	.	.	0.22	.	0.40	.	.
14	0.00	.	.	.	.	0.08	.	.	.	0.12	.	.
15	.	.	0.87	.	0.32	.	.	0.35	0.05	.	.	0.02
16	0.15	.	0.63	.	.	.	.	0.53	0.00	0.02	.	.
17	.	0.54	.	0.20	0.02	.	.	.	.	.	0.02	.
18	0.05	0.10	.	0.35	1.50	.	0.17	.	2.13	.	0.00	.
19	.	.	0.13	.	0.56	.	.	.	0.02	.	0.24	.
20	0.60	.	.	.	.	.	0.05	.	0.02	.	0.05	.
21	.	0.30	.	0.01	0.16	.	.	.	0.42	.	0.02	.
22	.	1.30	.	0.15	.	0.70	.	.	.	.	0.10	0.22
23	.	.	.	0.05	.	.	0.02	.	.	0.13	.	.
24	0.01	0.57	.	.	.	.	.	.	.	.	0.27	.
25	0.25	.	.	.	.	.	1.00	.	.	.	1.52	.
26	.	.	0.22	.	.	.	0.20	.	.	.	0.52	.
27	.	.	.	.	.	.	.	0.08	.	0.05	0.04	.
28	0.57	0.06	.	.	0.05	0.11	.	.	.	0.22	0.02	0.06
29	0.07	.	.	.	.	.	.	.	0.16	.	0.00	.
30	0.01	.	.	0.05	.	.	.	.	.	.	.	0.20
31	.	.	.	.	.	.	.	.	.	.	.	.
Total	3.95	5.74	3.35	1.64	5.21	1.20	1.05	1.62	3.79	3.13	4.31	2.21

* Snow.

Total for the year, 38.20.



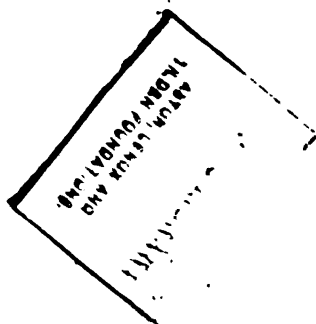


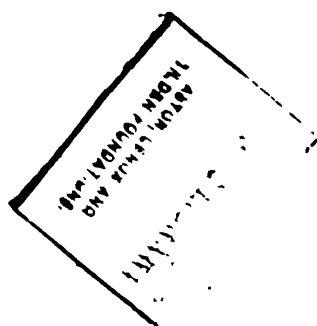
TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1900.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	..	1.16	..	..	..	..	..	..	..	..	..
2	*0.49	..	..	0.30	0.63	0.07	..	..	..	..	..	..
3	..	..	..	0.09	1.84	0.26	0.02	..	..	..	..	..
4	..	0.63	*0.03	..	..	..	..	..	..	..	..	..
5	..	0.02	*0.07	..	..	..	..	..	..	..	..	S&R
6	..	..	*0.32	..	..	..	..	..	..	..	..	1.30
7	..	..	..	..	..	..	0.10	0.18	..	0.03	..	..
8	0.01	0.63	..	..	0.01	0.09	..	0.18	..	..	..	..
9	..	0.07	..	..	0.23	..	..	0.01	..	0.68	0.24	..
10	S&R	..	..	..	..	..	..	0.10	..	1.12	..	..
11	1.34	..	..	..	..	..	..	..	..	0.15	0.15	..
12	..	0.96	..	0.50	..	..	0.38	..	..	0.46	..	..
13	..	0.29	..	..	..	..	..	0.30	..	0.38	*0.01	..
14	*0.09	..	S&R	..	..	0.08	..	..	..	0.06	..	..
15	..	..	1.11	..	0.32	..	..	0.38	1.09	..	..	..
16	..	..	0.63	..	..	..	..	0.74	0.29	..	..	..
17	..	0.12	..	0.17	..	..	..	..	2.12	..	..	..
18	0.10	..	..	..	1.25	..	0.23	..	0.05	..	0.05	..
19	S&R	..	0.12	..	0.72	..	..	..	..	..	0.15	..
20	0.57	..	..	..	..	0.77	..	..	0.02	..	..	..
21	..	..	..	..	0.16	..	..	..	0.36	..	..	..
22	..	1.72	..	0.16	..	..	..	..	..	..	0.07	..
23	..	..	..	0.05	..	..	..	..	..	0.12	..	0.19
24	..	0.92	..	..	..	..	..	..	..	..	0.19	..
25	0.34	..	..	..	..	..	1.10	..	..	..	1.42	..
26	..	..	*0.20	..	..	..	0.20	..	..	..	0.43	..
27	..	..	..	..	..	..	..	0.08	..	0.03	0.01	..
28	0.70	0.06	..	..	0.05	0.09	..	..	..	0.19	..	*0.04
29	..	..	..	..	..	..	..	..	0.17	..	0.89	0.29
30	..	..	..	..	..	..	..	..	..	..	0.08	0.03
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	3.64	5.42	3.64	1.27	5.21	1.36	2.03	1.97	1.15	3.22	3.69	1.85

* Snow.

Total for the year 37.40.



PUBLIC WATER BOARD REPORT.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY RAIL STATION.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
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26												
27												
28												
29												
30												
31												
Total	14	2.48	2.56	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27

* Trace.

Total for the year 17.40.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1900.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Glen Lewis Pond.
January 1	10.9	16.1 ¹ / ₂	8.10 ¹ / ₂	8.	17.2
January 9	9.6	16.2 ¹ / ₂	8.8	8.1	17.5
January 15	10.4	16.7	8.10 ¹ / ₂	8.5 ¹ / ₂	17.9
January 22	14.3	17.4	9.5	9.1	18.5
January 29	15.11 ¹ / ₂	18.	9.1	10.1	18.4
February 5	21.6	18.4	9.6	10.10	18.4
February 12	23.3	19.1	9.9	12.2	18.5
February 19	22.1	20.1 ¹ / ₂	13.4	13.7	18.4
February 26	23.11	21.5	16.9	15.10	18.5
March 5	23.9	21.3	19.5	17.4	18.5
March 12	23.6	20.4	20.11	17.3 ¹ / ₂	18.4
March 19	23.	20.2 ¹ / ₂	21.5	17.4 ¹ / ₂	18.5
March 26	22.6	20.	21.6	17.4	18.6
April 2	22.6	19.8	21.6	17.3	18.3
April 9	23.	19.10	21.6	16.9	18.
April 16	23.6	19.11 ¹ / ₂	21.5 ¹ / ₂	16.6	17.7
April 23	23.6	20.3	22.	16.8	16.
April 30	23.7	20.6	22.10	16.10	11.9
May 7	24.9 ¹ / ₂	21.2	23.	17.4	12.6
May 14	24.10	21.2	22.11	17.4	12.5
May 21	24.11	21.2	22.10	17.4	12.11
May 28	25.	20.9	22.9 ¹ / ₂	17.3	14.5
June 4	25.2	20.6	22.6	16.9	14.5
June 11	25.1 ¹ / ₂	20.2	22.3	16.4	14.6
June 18	24.9	19.7	22.	15.7	14.6
June 25	24.7	19.1	21.9	15.2	14.6
July 2	24.3	18.9	20.1	15.	14.6
July 9	23.11	18.6 ¹ / ₂	18.11	14.11	14.6
July 16	23.8	18.1	17.7	14.5	14.6
July 23	23.3	17.8	16.	14.6	14.6
July 30	23.1	17.6	14.8	14.6	14.6
August 6	22.6	17.3	14.4	13.4	14.4
August 13	21.2	17.1	14.1	13.4	14.4
August 20	21.	16.11	13.6	12.5	14.3
August 27	20.10	16.10	12.1	12.5	14.3
September 3	20.29	16.9	9.10	12.3	14.2
September 10	18.2	16.6	9.8	12.	14.1
September 17	17.7	16.6	9.6	11.9	14.1
September 24	16.2	16.10	9.7	11.8	14.9
September 31	15.10	16.7	9.5	10.7	14.9
October 7	15.9	16.9	8.10	10.	14.9
October 14	16.1	17.1	7.8	10.3	14.7
October 21	16.3	17.	6.	10.4	14.7
October 28	16.6	16.11	2.10	10.5	14.9
November 4	17.5	17.	...	8.10	14.9
November 11	15.2	17.	...	7.9	14.9
November 18	18.10	15.4	...	7.7	14.9
November 25	20.5	14.9	...	8.1	15.1
December 1	21.1	14.3	...	8.4	15.1
December 8	22.7	13.11	...	9.4	16.5
December 15	22.9	13.9	...	10.	17.4
December 22	22.7	13.11	...	10.1	17.6
December 29	22.4	14.2	...	10.2	17.5

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1900.

STREET.	LOCATION.
Broadway	On east line of Boston street, 21 feet, 6 inches north from south line of Broadway.
Broadway	On east line of Springvale avenue, 38 feet, 4 inches north from south line of Broadway.
Chestnut	On west line of Western avenue, 17 feet, 6 inches south from north line of Chestnut street.
Essex	On north line of Fayette street, 12 feet west from east line of Essex street.
Hood	On west line of Allen street, 17 feet, 8 inches south from north line of Hood street.
Locust	On south line of Collins avenue, 35 feet, 6 inches east from west line of Locust street.
Myrtle	On west line of Holyoke street, 13 feet, 6 inches north from south line of Myrtle street.
Nelson	On south line of Hood street, 14 feet, 6 inches west from east line of Nelson street.
Ocean avenue....	On north line of Wave street, 26 feet, 10 inches west from east line of Ocean avenue.
Summer.....	On west line of south street, 42 feet north from south line of Summer street.
Walnut	6-inch waste gate in Harmon's field, 2 feet south from main, 2 feet west from Brook.
Walnut	30-inch gate at pumping station.

TABLE VII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE.

KIND.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	1 in.	1 1/2 in.	2 in.	4 in.	Total
Trident	456	575	51	5	5	...	1,092
Thomson	169	373	99	17	3	2	663
Lambert	130	140	6	2	6	...	284
Hersey	82	89	2	1	...	...	144
Ball and Fitts	35	33	17	...	...	...	85
Union	2	24	10	7	8	13	64
Nash	53	13	1	...	...	...	67
Niagara	36	31	1	...	1	...	69
Columbia	47	5	...	...	...	...	52
Worthington	2	5	7	1	6	1	22
Weir	1	3	2	4	2	..	12
Crown	2	5	4	2	...	...	13
Empire . . . . .	...	1	...	...	3	...	4
Motors	2	...	...	...	...	...	...
Totals	1,015	1,267	200	39	34	16	2,571

Total gallons metered, 381,940,000.

TABLE VIII.

SHOWING CONSUMPTION IN GALLONS OF ESTIMATED AND METERED QUANTITIES.

Domestic, non-metered	1,018,488,000
Manufacturing, metered	234,340,000
Domestic, metered	147,600,000
Loss in registration, 5 per cent. estimated . .	1,909,700
Loss in distribution, 10 per cent. estimated pumpage	170,815,300

CITY PURPOSES.

Street sprinkling	67,000,000
Watering troughs	32,000,000
Schools	13,000,000
Fires	5,000,000
Sewers	3,000,000
Highway Department	3,000,000
Engine houses	2,000,000
Fountains	2,000,000
City Hall	1,000,000
Police Station	1,000,000
Health Department	1,000,000
Cemeteries	500,000
Public Library	500,000
Water Department	500,000
All others	500,000
	<hr/>
	135,000,000
Total	<hr/> 1,708,153,000

TABLE IX.

SHOWING TOTAL LENGTH AND SIZES OF SERVICES LAID IN LYNN AND SAUGUS.

	4 in.	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.	Total.
Lynn	132	252	122	631	3,048	3,069	116	7,370 feet.
Saugus . . . . .	.....	.....	.....	.....	871	1,344	.....	2,215 feet.
Total	132	252	122	631	3,919	4,413	116	9,585 feet

TABLE X.

SHOWING THE SIZE AND TOTAL LENGTHS OF IRON PIPE LAID IN 1900.

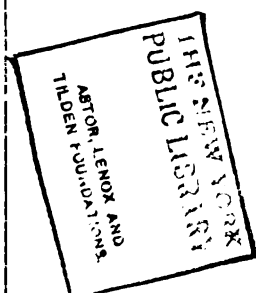
WHERE LAID.	30 in.	8 in.	6 in.	4 in.	Total.
Birch Pond to Pumping Station . . .	6,250				6,250
Allen*			400		400
Atkins avenue†				156	156
Broadway*		2,424			2,424
Chestnut*		1,813			1,813
Clark†				42	42
Essex*		768			768
Intervale†				156	156
Ireson*				494	494
Locust†			436		436
Myrtle*			492		492
Nelson*				649	649
Ocean avenue*				465	465
Quebec†			48		48
Rhodes†				216	216
Sewall†			393		393
Williams†				38	38
Summer*			587		587
	6,250	5,005	2,361	2,216	15,832

*Relaid, 7,627 feet. †Extension, 1,490 feet.

New, 8,205 feet.

15,832 feet.

	MILES.	FEET.
Total length laid in 1900		15,832
Total length relaid in 1900		7,627
Total length extended		1,490
Total previously laid	110	1,845
Total in Swampscott		1,788
Total in Saugus	18	3,652
Total in system	129	2,005



73,613

to 1901

of Lynn

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by one
& Co.
city, and
capacity,
1,000,000

es Creek

Loretz.
2,123,400

SHOWING THE

WHERE

Birch Pond to Pun
 Allen*
 Atkins avenue†
 Broadway*
 Chestnut*
 Clark†
 Essex*
 Intervale†
 Ireson*
 Locust†
 Myrtle*
 Nelson*
 Ocean avenue*
 Quebec†
 Rhodest†
 Sewall†
 Williamst†
 Sumner*

*Relaid, 7,627

New, 5,205 1

15,832

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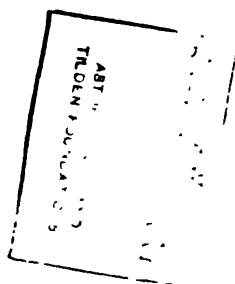
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Loretz.
2,123,400

SHOW!!

Birch Pos
 Allen*
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 Essex*
 Intervale
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 Locustt
 Myrtle*
 Nelson*
 Ocean av
 Quebec
 Rhodest
 Sewallt
 Williams
 Sumner*



*Rela
 New

Total
 Total
 Total
 Total
 Total
 Total

SUMMARY OF STATISTICS.

Report of 1900.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1900.

Lynn and Saugus,

73,613

Date of construction,

1870 to 1901

Owned by

City of Lynn

Source of supply,

Five artificial storage basins formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co. of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 11,500,000 daily capacity, one Loretz high service engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek

2. Cost of Coal,

3. Coal consumed for the year, in pounds,

Leavitt and High. Loretz.
593,700 2,123,400

4. Pounds of wood consumed in pounds coal,

2.5

190

	Leavitt and High.	Loretz.
5. Total consumed for the year (3)+(4),		
6. Total pumpage for the year, in gallons,	593,700	2,123,590
7. Average dynamic head against which the pump works,	378,782.675	1,330,784.875
8. a. Number of gallons pumped per pound of coal (5),	166.85	166.97
b. Number of gallons raised 100 feet per pound of coal (5),	638 00	626 06
9. Duty, in foot pounds per 100 pounds of coal, no deductions.	1,065.11	1,046.21
Duty = $\frac{\text{gallons pumped (6)} \times 8.34 \times 100 \times \text{dynamic head (7)}}{\text{total coal consumed (5)}}$	88,780,036	87,265,319

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$12,000.

10. Per million gallons raised against dynamic head (7) into reservoir,
11. Per million gallons raised one foot high (dynamic),
- \$7.02
- 4 20 cents.

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ. :
\$145,630.

12. Per million gallons raised against dynamic head (7) into reservoir,
13. Per million gallons raised one foot high (dynamic)
- \$85.10
- 50.90 cents.

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
<i>From Consumers:</i>			
A.	Water rates, domestic,	AA.	Management and repairs,
			\$62,717.77
B.	Water rates, manufacturing,	BB.	Interest on bonds,
			73,796.24
C.	Net receipts, for	CC.	Total maintenance,
			\$136,514.01
D.	Repairs and sundries,	DD.	Balance carried to sinking fund,
			72,309.02
E.	Premium on bonds,		
F.	Gross receipts from all sources,	EE.	Total,
			\$208,823.03

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	73,600
Estimated population supplied,	72,128
Total number of gallons consumed for the year,	1,708,153,070
No. of gallons metered,	340,000,000
Average daily consumption in gallons,	4,679.871
Gallons per day to each consumer.	64.85

DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron.
Size,	From 2 to 20 inches diameter.
Extended,	8,205 feet.
Total now in use,	Lynn, Saugus Swampscott, 129 miles, 2,005 feet.
Number of leaks for the year,	101
Hydrants added,	8
Hydrants now in use,	952
Gates added,	12
Gates now in use,	966
Range of pressure of city for day and night,	45 to 60 pounds.

CONSTRUCTION.

RECEIPTS.		EXPENDITURES.	
F. From balance of 1899, G. Pipes, meters and labor, H. Loans,	\$8,572.16	EF. New 30-inch conduit,	\$31,805.91
	3,466.41	GG. Extension of main lines,	7,346.71
	50,000.00	HH. Extension of service pipes,	6,611.49
		II. Hawkes Pond (land bought),	1,725.94
		JJ. Engineering,	1,236.78
		KK. Total construction for year,	\$48,726.87
		LL. Balance,	13,311.70
I. Total,	\$61,038.57	MM. Total,	\$61,038.57

Cost of works to date, \$2,472,821.85.
 Plus of sinking fund, \$524,027.50.

J. Bonded debt, Dec. 31, 1900, \$1,800,300.00.
 L. Rate of interest, 34.34. 4. 44. 5.

PUBLIC WATER BOARD REPORT.

CONSUMPTION.

Estimated population to date (Lyons and Sangre),
Estimated population supplied,
Total number of gallons consumed for the year,
No. of gallons metered,
Average daily consumption in gallons,
Gallons per day to each consumer.

DISTRIBUTION.

Kind of pipe used,
Size,
Estimated,
Time now in use,
Number of leaks for the year,
Inches wasted,
Inches now in use,
Inches lost,
Inches now in use,
How to measure

SERVICES.

Kind of pipe used,	Cement-lined and lead-lined
Size of pipe used,	$\frac{3}{4}$ to 4 inches in diameter.
Extended,	437
Discontinued,	489
Numbered of services added,	163
Number of services discontinued,	15
Number of services now in use,	12,569
Total length of services,	96 miles, 2,133 feet
Number of services added in Saugus,	43
Number of services now in use in Saugus,	935
Length of Services added in 1900,	2,215
Total length of services in Saugus,	8 miles, 5,110 feet
Meters added,	235
Meters now in use,	2,571

THE NEW-YORK
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TILDEN FOUNDATION

ANNUAL REPORT

OF THE

PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1901.



LYNN, MASS.:
WHITTEN & CASS, PRINTERS
1902

V D L A p-60



ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1901.

Compliments of

★ *Public Water Board,*

WILLIAM B. LITTLEFIELD,
Pres't.

LYNN, MASS.
WHITTEN & CASS, PRINTERS
1902



ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1901.



LYNN, MASS.:
WHITTEN & CASS, PRINTERS
1902



OFFICERS FOR 1901.

JAMES BURNS,
For one year.

C. E. SPRAGUE,
For two years.

THOMAS P. NICHOLS,
For three years.

WILLIAM B. LITTLEFIELD, *Pres.*
For four years.

S. W. DEARBORN,
For five years.

Superintendent and Clerk, D. A. SUTHERLAND.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, GEORGE H. VENN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. McLAIN.

INSPECTORS.

WINSLOW J. ROWELL,
J. FRANK POOL,

W. B. MOULTON,
JOHN CHAMBERLAIN.

PUBLIC WATER BOARD FOR 1902.

C. E. SPRAGUE, for one year.

THOMAS P. NICHOLS, for two years.

W. B. LITTLEFIELD, *Pres.*, for three years.

S. W. DEARBORN, for four years.

JAMES BURNS, for five years.

ANNUAL REPORT.

To the Honorable Mayor and City Council of the City of Lynn:

GENTLEMEN,—The Public Water Board herewith presents its thirtieth annual report, together with the reports of the Superintendent and Registrar.

Our Water Supply.

Our present system comprises:

Ponds.	Acres.	Capacity in Gallons.
Breed's	54.85	262,563,340
Birch	82.	381,062,901
Glen Lewis	36.	120,475,126
Hawkes	75	300,000,000
Walden	128	403,163,826
A total storage of		1,467,265,193

In connection with these sources we have a conduit from Saugus River to Hawkes Pond having a daily capacity for delivering about 30,000,000 gallons. The water-shed from which the city has a right to take the water which contributes to this supply contains less than 50 inhabitants to the square mile and is absolutely free from all direct sewage contamination.

Our total consumption this year was 1,644,672,843 gallons, or 177,407,650 gallons in excess of our storage capacity. As will readily be seen we should not exceed our storage capacity to have a safe supply in a growing city like ours. The Board are unanimous in their opinion that we cannot with safety allow our annual consumption to exceed our total storage capacity, for in a

year of low rainfall the city would find itself dangerously near a water famine.

We have tried to impress upon the minds of the members of the City Council the true condition of our supply and have presented the views of prominent hydraulic engineers, and have gone over the ground with the members, in order that they might clearly see and understand the true conditions.

In our visit in April last the several ponds were full to overflowing and millions of gallons were running to waste down the Saugus River. We then urged upon the members the wisdom of raising the dam at Walden Pond in order that we might store the spring storm waters. We will again present the report of Mr. Lucian A. Taylor, C. E. as a clear proposition of our plans :

Public Water Board, Lynn, Mass. :

GENTLEMEN,—In accordance with your instructions of Oct. 30th last, I have made studies and estimates for an additional storage basin for the Lynn Water Works.

The subject is one of considerable magnitude, and has required a great amount of thought and study, and various estimates of a number of schemes and projects.

It seems advisable to develop the storage capacity of the location of Walden and Glen Lewis Ponds by raising the present dam. Surveys and estimates have been made to develop the storage basin of Walden Pond to about its ultimate capacity. This has resulted in preparing estimates to raise the present dam 40 feet, and increasing the depth of water in the reservoir from 17 to 57 feet. The area of the reservoir will be increased from 164 to 331 acres, and the capacity from 523,639,000 to 3,591,682,000 gallons. The area will be almost exactly doubled, while the capacity is increased to seven times the present amount. The average depth of water will be 33.2 feet.

The raising of the main dam 40 feet also necessitates the building of a dam 400 feet in length at the head of Glen Lewis Pond, and three smaller dams along the Newburyport turnpike. Estimates have been made for all these dams; also for the clearing of the basin to an elevation of at least two feet above high

water mark. The surveys show the basin to be a remarkably good one in all respects for the storage of water, the sides of the reservoir being very steep, and no shallow flowage in any part. The average slopes of the sides of the basin are about 20 feet per 100, in many places as high as 50 per 100. This will be clearly seen by examining the accompanying table of capacities and area. The entire additional area to be flowed is covered with a small growth of wood, except the roadway along the valley, and it is, with the exception of very light soil, one mass of rock and boulders. There are no inhabitants within the entire radius of the water-shed.

To raise the dam 40 feet will increase the storage capacity of the reservoir 3,068,043,000 gallons. This is an average of a little more than 8,400,000 gallons per day additional storage. It would seem unnecessary to provide for so great an increase of storage capacity at the present time, and I have made plans and estimates for raising the dam 20 feet.

This will increase the area of the reservoir 240 acres, or 76 acres more than the present one, and the capacity to 1,754,157,078 gallons, an increase of 1,230,518,078 gallons. This increased storage equals a daily supply of a little more than 3,335,000 gallons. The area of this reservoir is increased 46 3-10 per cent., while the storage capacity is increased 232 1-2 per cent. The average depth of water will be 22.6 feet.

This additional storage will be sufficient to last the city of Lynn about seventeen years. At the end of that time, 20 feet additional can be added to the dam at a moderate expense, and its capacity increased by 1,850,744,000 gallons, and the area of the reservoir from 240 to 331 acres, an increase of 91 acres. This will give an additional supply of 5,070,000 per day.

The estimated expense of raising the present dam at Walden Pond 20 feet, with foundations of gate chamber and core wall of sufficient strength to raise the dam to an ultimate height of 40 feet, including the clearing and cleaning of the present ponds and the stripping of the additional area flowed, is \$359,015.00. In this no estimate is made for the pumping station at Hawkes Pond, which would be necessary. The estimated cost of the conduit, pumping station and pumps, complete, is fifty thous-

and dollars (\$50,000.00). As raised 20 feet, high water in Walden Pond will be 16 feet, nine inches above high water in Hawkes Pond.

The estimated expense of raising the dam the full height of 40 feet, including a dam at the head of Glen Lewis Pond, and three dams along the line of the Newburyport turnpike, clearing and grubbing the present pond and stripping of the additional area flowed, is \$622,511.00.

The cost of the dam and basin for storing 1,000,000 gallons, with the dam raised 20 feet, will be \$295,—the cost with the dam raised the full height of 40 feet, will be \$203. The increased cost in the first instance, of course, being due to the great expense of heavy foundations suitable for a dam 40 feet in height. The cost of storing the upper 20 feet will only be \$150 per million gallons. The following are the area capacity and cost of construction of dams and reservoirs, actual or estimated, at the various places :

	Area, Acres.	Capacity in Million Gallons.	Cost per Million Gallons.
Walden Pond Basin	331	3,591,000,000	\$203.00 (est.)
Boston Water Works, Basin No. 1,	143	280,000,000	918.00
Boston Water Works, Basin No. 2,	134	530,000,000	879.00
Boston Water Works, Basin No. 3,	253	1,080,000,000	388.00
Boston Water Works, Basin No. 4,	167	1,400,000,000	581.00
Boston Water Works, Basin No. 6,	185	1,350,000,000	590.00
City of Camb'ge, Hobbs Br'k Basin,	653	1,530,000,000	634.00
Worcester, Dam No. 1	72	500,000,000	478.00 (est.)
Worcester, Dam No. 2			746.00 (est.)
Worcester, Dam No. 3			1,043.00 (est.)

It will be seen that even the storage of the first 20 feet of water makes a very favorable showing, being considerably less than any of the reservoirs just mentioned. In the estimates, as stated, I have allowed for the cleaning of the entire basin. In a small portion of Glen Lewis and Walden Ponds, the mud will be left in place and covered with gravel instead of being excavated and carried away. I believe the estimates are liberal, and that the work can be accomplished for the amounts stated.

The following table gives the area and capacity of the present

reservoir, and also the area and capacity for each additional five feet in height :

Elevation.	Area, Acres.	Capacity, Gallons.
65.50	164	523,638,950
70.50	178	731,906,000
75.50	196	1,037,055,000
80.50	216	1,373,056,000
85.50	240	1,754,157,080
90.50	269	2,145,303,000
95.50	284	2,589,176,000
100.50	307	3,071,469,000
105.50	331	3,591,682,000

The above table, as well as the surveys of the entire basin, have been made by Mr. E. F. Dwelley in a most thorough and satisfactory manner. The accompanying plans show the sections and profiles of the several dams as proposed, and also some studies in connection with the main or principal dam.

Basing my judgment upon the above facts and figures, I recommend the raising of the present Walden Pond dam 20 feet, with foundation and core wall of sufficient strength to eventually raise the dam 20 feet more.

In concluding, will say I know of no reservoir of similar size and character so good for the storage of water as the proposed basin or that can be constructed with so small an expense per million gallons, or where the average depth of water is so great compared with the area. I also believe storage in this deep basin will greatly improve the quality of the water stored.

Respectfully submitted,

LUCIAN A. TAYLOR,
Consulting Engineer.

Boston, May 7, 1900.

In our last report the Water Board recommended an early presentation of the petition to the Legislature for the right to take Ipswich River and its tributaries, embracing a water-shed of 27 square miles at a point above the mills in Middleton.

The petition was duly presented and the Legislative Committee set April 29, as the day when they would visit the territory desired. In conjunction with this Board and the City Council the trip was made to the Ipswich River, taking in on the way our present system. The committee seemed very much surprised and were very enthusiastic in their expressions of the natural advantages, not only for securing an unlimited supply, but the natural basin for storing the same, being free from all contamination and located within our Park domain. With an increased depth of 20 feet we can feel assured of a supply of good and wholesome water equal in quality to any in the State.

The Legislative Committee gave a hearing at which His Honor the mayor, the city solicitor, this board and several of our prominent citizens were present. There being no objections of any import the petition was favorably recommended and the following Act adopted :

CHAPTER 508, ACTS OF 1901.

AN ACT TO AUTHORIZE THE CITY OF LYNN TO TAKE AN ADDITIONAL WATER SUPPLY.

Be it enacted, etc., as follows :

SECTION 1. The city of Lynn may, for the purpose of providing an additional water supply for itself and its inhabitants, take by purchase or otherwise, the water of Ipswich River and its tributaries including Martin's pond, above the point where said Ipswich River intersects the junction of the boundary line of the towns of Lynnfield, North Reading and Middleton, reserving to the owners of mills on said river their right as mill owners to use such waters as shall flow to said mills and the dams connected therewith, except so far as said city shall from time to time actually divert and use the same for the purposes named in this Act: provided, that the city of Lynn shall not take water from the Ipswich River except when the daily flow of said river at the paper mill dam in the town of Middleton shall exceed ten million gallons, and then at such times said city may take all the flow of said river in excess of ten million gallons and no more, and shall only exercise the right to take the waters above mentioned during the months of December, January, February, March, April and May; and may take, by purchase or otherwise, all lands, rights of way and easements necessary for establishing filtration beds for holding and preserving all water taken by purchase or otherwise under authority of this Act, and for conveying the same to any part of said city, and may

erect on the land thus taken or held proper dams, buildings, fixtures and structures, and may make excavations, procure and operate machinery, and provide such other means and appliances as may be necessary for the establishment and maintenance of complete and effective water works; and, for the purposes aforesaid, may construct and lay down conduits, pipes and other works, under, through or over any lands, water courses, public works, railroads, public or private ways, and along such ways in such manner as not unnecessarily to obstruct the same; and for the purpose of constructing, repairing and maintaining said conduits, pipes and other works, and for all proper purposes of this act, said city may dig up any such lands, and, under the direction of the selectmen of the town in which such ways are situated, may enter upon and dig up any such way or ways in said town, in such manner as to cause the least hindrance to public travel; provided, however, that nothing contained in this Act shall be construed to alter or diminish the powers of the state board of health under general laws now in force in regard to water supplies of cities and towns.

SECTION 2. The said city shall, within sixty days after the taking of any lands, rights of way, water rights, water sources or easements as aforesaid, otherwise than by purchase, file and cause to be recorded in the registry of deeds for the county and district within which such lands or other property are situated, a description thereof sufficiently accurate for identification, with a statement of the purposes for which the same are taken, signed by the mayor of said city.

SECTION 3. The said city shall pay all damages sustained by any person in property by the taking of any land, right of way, water, water source, water right or easement, or by any other thing done by said city under authority of this Act; provided, however, that said city shall not be liable to pay any damages resulting from the taking and using water from Martin's Pond other than the Commonwealth itself would be legally liable to pay. Any person sustaining damages as aforesaid under this Act, who fails to agree with said city as to the amount of damages sustained, may have the damages assessed and determined in the manner provided by law in the case of land taken for laying out highways, on application at any time within the period of three years from the taking of such land or other property, or the doing of other injury under the authority of this act; but no such application shall be made after the expiration of said three years. No application for the assessment of damages shall be made for the taking of any water, water right, or for any injury thereto, until the water is actually withdrawn or diverted by said city under authority of this Act.

SECTION 4. The said city may, for the said purposes of procuring and providing for an additional water supply, issue from time to time, bonds, note or scrip to an amount not exceeding five hundred thousand dollars. Such bonds, notes and scrip shall bear on their face the words, City of Lynn Water Loan, Act of 1901; shall be payable at the expiration of

periods not exceeding thirty years from the date of issue; shall bear interest payable semi-annually, at a rate not exceeding six per cent. per annum; and shall be signed by the treasurer of the city and countersigned by the Public Water Board. The city may sell such securities at public or private sale, or pledge the same for money borrowed for the purposes of this Act, upon such terms and conditions as it may deem proper. The city shall provide at the time of contracting said loan for the establishment of a sinking fund and shall annually contribute to such fund a sum sufficient with the accumulations thereof to pay the principal of said loan at maturity.

SECTION 5. Whoever wilfully or wantonly corrupts, pollutes or diverts any of the waters taken or held under this Act, or injures any structure, work or other property owned, held or used by the city under the authority and for the purposes of this Act shall forfeit and pay to the city three times the amount of damages assessed.

SECTION 6. The city shall have power to establish filtration beds for the filtering of its present water supply or any additional water supply taken under this Act, on land already owned by the City of Lynn or on land taken under authority of section one of this act, as it may deem advisable, and to apply to said purpose any portion of the loan authorized by section four of this Act: provided, however, that before the said City of Lynn shall proceed to establish any filtration beds or system of filtration authorized by this section, it shall submit the general plans for the same to the State board of health and receive its approval before the work is commenced.

SECTION 7. The Public Water Board of the City of Lynn shall have and exercise under this Act all like powers and privileges which it now has and exercises under the provisions of chapter two hundred and eighteen of the Acts of the year eighteen hundred and seventy-one.

SECTION 8. Nothing contained in this Act shall prevent the Town of Reading from taking from said Martin's Pond or Ipswich River a supply of water for similar purposes whenever said town may require the same: provided, however, that said town shall pay all land or other damages caused by any such taking by said town. The right herein given to the City of Lynn shall in no way alter or abridge the right already given to or exercised by the Town of Reading under the provisions of chapter four hundred and five of the Acts of the year eighteen hundred and eighty-nine.

SECTION 9. This act shall take effect upon its passage. [*Approved June 14, 1901.*]

The past year has been very favorable for our supply, the rainfall having been 50.40 inches or nine inches above the average. Should the next year be nine inches below the average it would be necessary to use every precaution against unnecessary waste in order to supply the city.

On December 13th the City Council passed an order appropriating the sum of seventy-five thousand dollars (\$75,000) for the purpose of erecting an engine house, and the purchase of an engine, boiler and pump; also for cutting off the wood and cleaning and grubbing the slopes of the pond. The Board has carried out the order by cutting off the wood and clearing the slopes of undergrowth; has contracted for the building of an engine house and secured an engine, boiler and pump with a pumping capacity of 30,000,000 gallons daily. We shall proceed to install the same as soon as possible in order that we may prosecute the work on the building of the dam several weeks longer than we could otherwise, were we obliged to cease work in order that the water-shed would have to be utilized to insure a full supply. With our new pumping system we can not only put 30,000,000 gallons daily into Walden Pond, but when our full plans are carried out we would be able to pump to our reservoir should anything serious happen to our present pumping system. We would urge upon the City Council the necessity of an early appropriation of the balance of the \$400,000 in order that we may push to a successful completion the work so auspiciously begun, thereby insuring our growing and prospering city against any lack of this most necessary blessing to a community like ours.

Biological.

Weekly biological examinations have been made of all the sources showing the water to be of the usual good quality, and it will be the aim of the Board to not only maintain the present standard in quality but to use every effort to improve it. We shall, as soon as possible, lower the water table between Hawkes Pond and Nell's Pond now of a swampy nature, thereby improving the water in color and quality.

Canal.

Two 30-inch mains have been laid in the canal and one connected with the 30-inch pipe to Walden Pond. When the line is completed to Hawkes Pond we will be enabled to fill Birch and Breed's Ponds by gravity from either Hawkes or Walden Ponds, thereby doing away with the pumping station at

Birch Pond making a large saving each year in cost of pumping water into Birch Pond, and the open canal will be done away with, which will relieve the department of *another* expense and be a great saving in water, as a large amount percolates through the sides of the canal and finds its way to the brooks.

Electrolysis.

The Board calls the attention of the City Council to the destruction of mains and service pipes caused by electrolysis, which continues to increase from year to year. The matter is a serious one and some steps should be taken to prevent future destruction.

We would recommend that no further franchise or extension of electric railroads be granted where they allow the current to be grounded in the city limits, or in any way allow the current to come into the city in such a way that it would come in contact with the pipes. This matter should receive your early attention as pipes are being destroyed daily along the line of the electric road.

Statement.

WATER DEBT.

Amount of debt, December 19, 1900 . . .	\$1,810,300 00	
Bonds issued in 1901	25,000 00	
	<hr/>	\$1,835,300 00
Bonds paid in 1901		60,000 00
		<hr/>
Amount of debt, December 19, 1901 . . .		\$1,775,300 00

SINKING FUNDS.

Amount of funds, December 20, 1900 . . .	\$451,718 48	
Received from Treasurer, 1901	72,309 02	
Income from Investments in 1901	15,309 54	
	<hr/>	\$639,337 04
Deduct amount paid on bonds in 1901 . . .		50,000 00
		<hr/>
Amount in hands of Commissioners, December 19, 1901		\$589,337 04
Balance in hands of Treasurer, December 19, 1901		52,097 05
		<hr/>
		\$641,434 09
Net water debt		\$1,133,865 91

Treasurer's Statement for the Year Ending December 19, 1901.

RECEIPTS.

From water rates	\$199,828 88	
From premiums on loans	1,697 25	
From accrued interest on bonds sold	29 16	
	<hr/>	\$201,555 29

EXPENDITURES.

For maintenance	\$76,862 00	
For interest	72,596 24	
	<hr/>	149,458 24
Net income		<hr/> \$52,097 05

Respectfully submitted,

WILLIAM B. LITTLEFIELD, *Pres.*
 CHARLES E. SPRAGUE,
 STEPHEN W. DEARBORN,
 THOMAS P. NICHOLS,
 JAMES BURNS.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
Lynn, Mass., January 1, 1902.

To William B. Littlefield, President:

SIR,—I herewith present the financial condition of the department for the year ending December 31, 1901.

RECEIPTS FOR 1901.

Fixture rates	\$113,967 99	
Meter rates	78,333 40	
Miscellaneous	6,437 61	
Additional rates	1,744 02	
Fines	59 70	
Total revenue	<u>200,542 72</u>	\$200,542 72
Extra pipe	1,878 33	
Total receipts as per cash book		\$202,421 05

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$200,542 72	
Amount outstanding, fixture rates	\$17,342 49	
Amount outstanding, meter rates	7,377 05	
Amount outstanding (not due), meter rates	<u>16,898 92</u>	
	41,648 46	
	<u>\$242,191 73</u>	
Deduct amount due January 1, 1901	39,112 18	
Revenue for 1901	\$203,078 45	
Revenue for 1900	<u>199,003 54</u>	
Increase		\$4,074 91

PUBLIC WATER BOARD REPORT.

19

STATEMENT OF NET EARNINGS FOR 1901.

Revenue	\$203,078 45
EXPENSES.	
Interest	\$72,596 24
Maintenance	70,755 52
Rebate to Saugus	4,248 09
	<hr/> 147,599 85
Net earnings	\$55,478 60

EXPENDITURES FOR THE YEAR 1901.

MAINTENANCE.

Mains	\$18,160 32
Pumping expenses	11,740 85
Canal and Birch Pond	9,332 81
Salaries and office expenses	9,297 43
Meters	5,591 77
Services	5,509 54
Stable and shop	3,737 63
Miscellaneous	2,214 16
Engine house	1,738 75
Engines and boilers	1,162 60
Pumping (Birch Pond)	654 22
Hawkes Pond and conduit	443 22
Shed	435 99
Taxes	389 10
Walden Pond	155 50
Damages	145 37
Laboratory	45 74
	<hr/> \$70,755 52

CONSTRUCTION.

Services	\$4,906 74
30" conduit to pumping station	4,189 50
Hawkes Pond and canal	3,810 68
Mains	1,641 19
Birch Pond and canal	1,204 52
Engineering	675 00
	<hr/> \$16,427 63
Less amount received for pipe	1,878 33
Net	<hr/> \$14,549 30

STATEMENT

SHOWING COST OF WORKS TO JANUARY 1, 1902.

Mains, hydrants and gates	\$878,901 45
New supply and land	338,595 27
Services and courts	310,778 98
Walden and Glen Lewis Ponds	185,179 42
Engines and boilers	140,327 29
Hawkes Pond	161,036 53
Reservoirs and land	131,581 49
Birch Pond and land	93,471 84
Engine house and land	57,562 39
Breed's Pond and land	57,135 28
Pipe conduits and land	81,289 39
Hawkes Pond canal	47,647 33
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,274 07
Highland service	12,431 17
Engineering	11,157 95
Tubular wells	9,470 02
Workshop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,632,489 39
Less amount received for pipe	145,118 24
	<hr/>
Total net cost	\$2,487,371 15

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,755	
Number of services in Saugus	967	
Total	<u> </u>	12,722
Number put in during the year (Lynn)	150	
Number put in during the year (Saugus)	34	
Total	<u> </u>	184
Number extended during the year (Lynn)	30	
Number extended during the year (Saugus)	1	
Total	<u> </u>	31
Renewed	27	
Number discontinued	9	
Number not in use	48	
Turned on (new services)	113	
Turned on (reoccupied)	231	
Turned on (repairs)	20	
Shut off (for vacancy)	275	
Shut off (for non-payment)	20	
Shut off (for repairs)	47	

STATEMENT

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
 ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
 CONTAINED IN THE SAME, TOGETHER WITH THE
 NUMBER OF FIRE HYDRANTS, DEC. 31, 1901.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	11,798	907	12,705
Stores and shops	1,220	44	1,264
Factories	194	2	196
Offices	498	15	503
Restaurants and saloons	79	..	79
School-houses	56	7	63
Churches	32	5	37
Bakeries	30	..	30
Laundries	19	..	19
Engine houses	11	3	14
Families	16,391	991	17,382
Boarding-houses	225	2	227
Faucets	30,811	1,791	32,602
Water-closets	13,997	431	14,428
Bath tubs	5,379	337	5,716
Hose bibs	3,211	159	3,370
Urinals	187	8	195
Heaters	910	63	973
Stationary engines	161	6	187
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	29	..	29
Stand-pipes for fire purposes	17	1	18
Stand-pipes for water-carts	75	..	75
Sewer connections	25	..	25
Automatic sprinklers	97	2	99
Hydrants	804	155	959
Hydrants for car sprinklers	40	1	41

STATEMENT

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	. . .	\$8,989 00
From January 1, 1872, to January 1, 1873	. . .	27,568 15
From January 1, 1873, to January 1, 1874	. . .	47,992 61
From January 1, 1874, to January 1, 1875	. . .	53,545 61
From January 1, 1875, to January 1, 1876	. . .	52,553 26
From January 1, 1876, to January 1, 1877	. . .	60,807 12
From January 1, 1877, to January 1, 1878	. . .	64,002 50
From January 1, 1878, to January 1, 1879	. . .	67,570 14
From January 1, 1879, to January 1, 1880	. . .	73,949 80
From January 1, 1880, to January 1, 1881	. . .	79,635 12
From January 1, 1881, to January 1, 1882	. . .	80,967 76
From January 1, 1882, to January 1, 1883	. . .	94,419 52
From January 1, 1883, to January 1, 1884	. . .	98,893 54
From January 1, 1884, to January 1, 1885	. . .	114,903 86
From January 1, 1885, to January 1, 1886	. . .	110,089 11
From January 1, 1886, to January 1, 1887	. . .	116,375 70
From January 1, 1887, to January 1, 1888	. . .	123,507 73
From January 1, 1888, to January 1, 1889	. . .	134,480 27
From January 1, 1889, to January 1, 1890	. . .	141,865 53
From January 1, 1890, to January 1, 1891	. . .	154,788 27
From January 1, 1891, to January 1, 1892	. . .	171,744 85
From January 1, 1892, to January 1, 1893	. . .	188,979 88
From January 1, 1893, to January 1, 1894	. . .	177,803 56
From January 1, 1894, to January 1, 1895	. . .	176,655 50
From January 1, 1895, to January 1, 1896	. . .	185,572 88
From January 1, 1896, to January 1, 1897	. . .	190,531 33
From January 1, 1897, to January 1, 1898	. . .	183,711 97
From January 1, 1898, to January 1, 1899	. . .	186,658 35
From January 1, 1899, to January 1, 1900	. . .	193,699 01
From January 1, 1900, to January 1, 1901	. . .	199,003 54
From January 1, 1901, to January 1, 1902	. . .	203,078 45

\$3,764,403 93

FUNDED WATER LOAN.

When Payable.	Rate Per Cent.	Amount.
Mar. 1, 1903	4	\$8,000
May 1, 1904	3 $\frac{1}{2}$	7,300
Jan. 1, 1905	5	200,000
Apr. 1, 1905	4	150,000
May 1, 1905	3 $\frac{1}{2}$	66,500
Dec. 1, 1905	3 $\frac{1}{2}$	5,000
Nov. 1, 1913	4	20,000
Nov. 1, 1913	3 $\frac{1}{2}$	31,000
Mar. 15, 1914	4	50,000
Dec. 1, 1914	4	20,000
Dec. 1, 1915	3 $\frac{1}{2}$	6,000
Apr. 1, 1916	3 $\frac{1}{2}$	2,000
May 1, 1916	3 $\frac{1}{2}$	24,500
Sept. 1, 1916	4	10,000
Oct. 1, 1916	4	9,000
Feb. 1, 1917	3 $\frac{1}{2}$	6,500
June 1, 1917	3 $\frac{1}{2}$	3,500
July 1, 1917	4	7,500
Aug. 1, 1917	4	5,000
Oct. 1, 1917	4	2,000
Nov. 1, 1917	4	6,500
Apr. 1, 1918	4	15,000
June 1, 1918	4	10,000
July 1, 1918	4	50,000
Apr. 1, 1919	4	100,000
July 1, 1919	4	110,000
Jan. 1, 1920	4	35,000
Apr. 1, 1920	4	150,000
Apr. 1, 1921	4	50,000
Oct. 1, 1921	4	25,000
Jan. 1, 1922	4	50,000
July 1, 1922	4	25,000
Apr. 1, 1923	4	40,000
July 1, 1925	4	165,000
July 1, 1926	4	50,000
Sept. 1, 1927	4	25,000
July 1, 1928	4	25,000
Oct. 1, 1928	4	10,000
July 1, 1929	4	25,000
Jan. 1, 1930	4	25,000
Oct. 1, 1930	4	25,000
Note (on demand)	4	100,000
July 1, 1931	4	25,000

\$1,775,300

REPORT OF SUPERINTENDENT.

To Wm. B. Littlefield, President Public Water Board:

SIR,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1901.

The Water Supply.

The following ponds have contributed the water supply during the past year :

Walden Pond, 479,445,809 gallons; Birch Pond, 418,146,400 gallons; Hawkes Pond, 407,828,633 gallons; Breed's Pond, 338,842,413 gallons; a total of 1,644,263,255 gallons.

Total used (1900), 1,709,567,550 gallons.

On November 1, 1901, there was stored in the several ponds as follows :

Hawkes Pond, 209,019,492 gallons; Walden Pond, 111,430,300 gallons; Breed's Pond, 82,066,777 gallons; Glen Lewis Pond, 66,717,484 gallons; Birch Pond, 43,275,132 gallons; a total of 512,509,185 gallons.

Total storage, November 1, 1900, 419,765,479 gallons.

The water has been of good quality throughout the year. By our weekly analysis we are able to discover any growth tending to make the water unpalatable and thereby change to some pond not thus affected, insuring our takers the best at all times. We hope when our pipe line is continued to Hawkes Pond we will be able to keep Birch Pond full and thus not only make it look more wholesome but insure a full reservoir to draw from all the time.

Canal.

In August a heavy growth of grass developed in the canal, but it was soon removed with no bad effects resulting therefrom.

The Board deemed it expedient to lay pipes in the canal with a view of securing the head of Hawkes and Walden Ponds and thus not only save the expense of pumping into Birch Pond above the plane of eight feet but also reducing the care of the open canal eliminating the dust and leaves which blew in by the roadside.

We have already laid two lines of 30-inch pipe from the upper end of the tunnel to the site of the proposed new pumping station, one line continuing to Walden Pond and completed, the other line we hope to lay the coming season. This pipe has been secured by taking out the pipe laid through the bottom of Birch Pond in 1884. It was apparently as good as the day it was laid, being free from corrosion, even the name of the maker being legibly observed. The task of removing the pipes was by no means an easy one, but under the direction of Mr. A. J. Loretz, C. E., and the superintendence of H. G. Littlefield, the same was accomplished.

Hawkes Brook.

The water table contributing to Hawkes Brook from Nell's Pond being of a swampy nature we intend as soon as possible to clean out the bed of the brook and lower the table so as to avoid so far as we can any contamination in this direction.

Pumping Station.

The pumping station has been repaired and painted on the inside; the Leavitt engine has been put in good condition and the grounds improved in general appearance.

Shed.

A new shed has been built in the stable yard giving us a much needed improvement.

New Mains.

New mains have been laid in Barney, Dixon, Dearborn avenue, Temple and extensions in Bacheller, Whitney, Eastern avenue.

Mains Relaid.

Mains have been relaid in Alice, Boston (from Cedar to Washington), Chestnut (from Essex to Logan), Church, from

So. Common to railroad centre, Marion, No. Federal to Boston street, Empire, Essex (from Eastern avenue to Chatham), Western avenue (from Mall to Congress), and Kirtland with cast-iron pipe, removing 10,419 feet of old cement-lined pipe which was superanuated, we shall continue to renew the old pipe relaying the mains in the streets where we have the most frequent bursts, hoping to avoid annoyance to our takers and removing all claims for damage.

During the year 11 gates have been set in connection with the new mains; two new gates replaced the old; 15 street sprinkler hydrants were repaired; four fire hydrants and 38 hydrant leaks were repaired; three new hydrants replaced the old and three new were added; 16 main gate boxes were raised where streets were graded; 45 feet of ledge was excavated in trenching; 184 services were put in; 31 were extended; nine were discontinued, 27 were renewed; 56 services were changed from the old to the new main; one was lowered; 14 service boxes were changed where streets were graded; 1,042 services were bushed out; 217 lead connections were renewed; 127 stop-boxes were reset; 265 leaks in service pipe repaired; 115 stop-and-wastes were renewed; 10 private hydrants, four drinking fountains were repaired; 325 meters were set and 45 changed; 10 outside meter boxes were renewed; four new boxes put in; 261 meters repaired.

The following tables show the work performed by the department during the year.

Respectfully submitted,

D. A. SUTHERLAND,

Superintendent.

Microscopical Examination of Water from Birch Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	October 10.	November 15.	December 11.
Number of Sample	34732	35066	35357	35623	35990	36329	36793	37521	37973	38273
Plants.										
DIATOMACEÆ:	30	24	126	169	251	86	1176	106	99	184
Asterionella	4	17	100	48	42	4	483	6	25	139
Cyclotella	25	2	0	26	204	38	16	0	0	0
Melosira	0	0	0	16	0	0	56	36	8	0
Tabellaria	0	2	8	69	5	42	506	37	60	8
CYANOPHYCEÆ:	0	0	0	0	0	1	4	0	0	0
ALGÆ:	0	0	0	0	0	9	6	30	9	1
Animals.										
INFUSORIA:	3	13	260	526	1	5	8	17	7	22
Dinobryon	3	4	194	464	0	0	2	13	0	0
Synura	0	1	64	59	0	0	0	0	0	1
Uroglena	0	0	0	0	0	3	0	1	3	1
VERMES:	0	2	2	0	3	0	0	3	13	2
CRUSTACEA:										
Cyclops	pr.	0	0	0	0	0	0	0	pr.	0
MISCELLANEOUS:										
Zoogloeæ	3	5	5	5	5	5	7	5	10	5
Total	36	44	393	700	260	106	1201	161	138	214

Microscopical Examination of Water from Breed's Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.	November 15.	December 11.
Number of Sample . .	34380	34733	35067	35358	35623	35991	36330	36794	37206	37522	37974	38274
Plants.												
DIATOMACEÆ:	144	72	100	24	41	607	14	99	57	85	41	59
Asterionella	79	65	50	3	16	262	0	38	20	29	16	39
Tabellaria	41	4	22	16	4	300	4	60	37	13	12	0
CYANOPHYCEÆ,	0	0	0	0	0	0	0	1	0	3	32	0
Anabaena	0	0	0	0	0	0	0	1	0	0	32	0
ALGÆ:	0	0	0	0	0	0	36	73	18	7	4	0
Protococcus	0	0	0	0	0	0	30	68	5	0	0	0
Animals.												
INFUSORIA:	37	3	76	406	2284	2	11	31	12	9	17	4
Dinobryon	36	0	73	396	2280	0	0	30	0	0	0	0
Peridinium	0	0	3	2	1	0	0	0	11	0	2	3
Uroglena	0	0	0	4	0	0	0	0	0	0	0	0
VERMES:	6	1	2	0	0	1	0	1	1	0	2	1
CRUSTACEA: Cyclops,	0	0	0	0	0	pr.	0	0	0	0	pr.	0
MISCELLANEOUS:												
Zoogloea	5	3	7	8	5	5	3	3	5	5	5	5
Total	192	79	185	438	2330	615	64	208	93	109	101	69

Microscopical Examination of Water from Glen Lewis Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.		
Number of Sample . .	34381	34734	35068	35359	36624	35994	36331	36795	37207	37523		
Plants.												
DIATOMACEÆ:	45	0	44	63	378	262	5	53	25	976		
Asterionella	31	0	5	18	65	112	0	0	0	200		
Melosira	8	0	32	34	206	133	0	35	11	376		
Tabellaria	4	0	1	9	13	15	5	16	9	396		
CYANOPHYCÆ:	0	1	2	2	0	30	409	148	14	60		
Anabæna	0	0	0	0	0	8	9	68	1	0		
Clathrocystis	0	1	2	2	0	22	400	80	13	60		
ALGÆ:	4	2	6	10	4	12	0	2	13	0		
Animals.												
INFUSORIA:	151	1509	884	95	17	8	43	43	12	52		
Dinobryon	127	1496	864	4	11	8	0	0	0	0		
Euglena	0	0	6	41	0	0	42	3	0	12		
Peridinium	5	6	8	39	0	0	0	0	2	0		
Trachelomonas	12	2	2	1	6	0	1	40	10	40		
Uroglena	1	2	3	10	0	0	0	0	0	0		
VERMES:	9	2	1	0	0	2	2	0	0	4		
CRUSTACEA:												
Cyclops	0	pr.	0	0	0	pr.	0	pr.	pr.	0		
MISCELLANEOUS:												
Zooglaa	5	3	10	8	5	10	5	5	5	10		
Total	214	1517	947	178	404	324	464	251	69	1102		

Microscopical Examination of Water from Hawkes Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.	November 15.	December 11.
Number of Sample . .	34382	34735	35069	35360	35625	35992	36332	36796	37208	37524	37975	38275
Plants.												
DIATOMACEÆ:	1736	28	17	15	376	14	12	35	27	0	55	96
Asterionella	50	0	1	8	230	0	0	25	0	0	14	49
Cyclotella	1676	28	0	0	22	8	5	4	1	0	38	47
Synedra	6	0	5	0	54	4	1	0	6	0	2	0
Tabellaria	4	0	11	7	70	2	6	6	17	0	0	0
CYANOPHYCEÆ:	0	0	0	0	0	1	5	1	6	0	0	0
ALGÆ:	0	0	0	0	3	7	72	6	4	1	1	0
Animals.												
INFUSORIA:	10	1	122	25	10	1	11	383	5	0	1	1
Dinobryon	9	0	116	9	8	0	0	366	0	0	0	1
Euglena	0	1	3	15	1	0	9	1	0	0	0	0
Trachelomonas	0	0	0	0	0	1	0	12	2	0	0	0
VERMES:	0	0	0	1	0	0	2	7	0	0	0	0
CRUSTACEA:												
Cyclops	0	0	0	0	0	0	pr.	0	0	0	0	0
MISCELLANEOUS,												
Zoogloeæ	3	3	12	7	7	5	3	5	5	3	5	3
Sponge spicules	0	0	0	0	54	0	0	0	0	0	0	0
Zoospores	0	0	0	0	0	0	0	20	0	0	0	0
Total	1749	32	151	48	450	28	105	457	47	4	62	100

Microscopical Examination of Water from Howlett's Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.	November 15.	December 11.
Number of Sample . .	34383	34736	35070	35361	35620	35993	36333	36797	37209	37525	35976	38276
Plants.												
DIATOMACEÆ:	12	4	18	18	26	164	2	25	2	4	4	4
Fragilaria.	4	0	0	0	0	120	0	0	0	0	0	0
CYANOPHYCEÆ:	0	0	0	0	0	0	0	0	1	0	0	0
ALGÆ:	0	4	0	1	0	4	8	27	3	0	0	0
Animals.												
RHIZOPODA:	0	0	0	0	0	0	1	0	0	0	0	0
INFUSORIA:	30	2	22	55	1	13	3	4	7	0	0	71
Dinobryon	28	1	22	46	0	0	0	0	0	0	0	69
Vorticella	0	0	0	0	0	12	0	0	0	0	0	0
VERMES:	0	1	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS:												
Zoogloeæ	3	5	10	3	3	5	5	5	5	3	3	5
Total	45	16	50	77	30	186	19	61	18	7	7	80

Microscopical Examination of Water from Walden Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.	November 15.	December 11.
Number of Sample . .	34384	34737	35071	35362	35627	35995	36334	36798	37210	37526	37977	38277
Plants.												
DIATOMACEÆ:	42	11	6	41	83	93	7	272	284	1306	260	232
Asterionella	2	7	5	15	31	8	0	41	25	192	177	114
Melosira	0	0	0	21	25	72	6	0	95	252	46	0
Synedra	40	0	1	1	10	13	1	21	0	440	4	118
Tabellaria	0	4	0	4	17	0	0	210	164	420	31	0
CYANOPHYCEÆ:	0	0	0	0	0	0	0	9	0	6	1	0
ALGÆ:	5	7	3	0	5	2	1	19	6	124	1	2
Staurostrum	1	1	2	0	1	0	1	7	4	64	1	0
Animals.												
INFUSORIA:	333	420	248	50	8	4	45	4	2	22	352	7
Chlamydomonas	202	12	0	5	0	0	0	0	0	0	350	0
Dinobryon	40	352	191	10	0	0	11	0	0	16	0	0
Euglena	0	0	0	0	4	1	31	3	0	0	0	1
Peridinium	1	53	57	35	0	0	1	0	0	2	1	5
Uroglena	0	1	0	0	0	2	0	1	2	2	1	1
VERMES:	1	4	1	1	3	1	2	1	0	2	5	10
CRUSTACEA: Cyclops,	0	0	0	0	0	0	0	0	0	pr.	0	0
MISCELLANEOUS:												
Zoogloea	3	3	10	5	3	5	3	5	3	7	5	5
Total	384	445	268	97	102	105	58	310	295	1467	624	256

Microscopical Examination of Water from Saugus River at Montrose.

Number of Organisms per Cubic Centimeter.

Day of Examination.. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.	November 15.	December 11.
Number of Sample . .	34385	34738	35072	35364	35629	35996	36335	36799	37212	37527	37978	38279
Plants.												
DIATOMACEÆ:	4	6	0	22	65	69	8	16	0	24	8	20
CYANOPHYCÆ:	0	0	0	0	0	0	0	0	0	20	0	0
Anabæna	0	0	0	0	0	0	0	0	0	20	0	0
ALGÆ:	0	0	0	0	8	0	10	1	0	3	5	0
Animals.												
INFUSORIA:	51	21	2	94	3	0	0	0	4	1	0	101
Dinobryon	44	20	0	92	0	0	0	0	0	3	10	99
Uroglena	1	1	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS, Zooglyca	3	3	10	5	3	3	3	5	3	5	3	5
Total	58	30	12	121	79	72	21	22	7	53	26	126

Microscopical Examination of Water from a Faucet in Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1901.	January 10.	February 13.	March 13.	April 10.	May 9.	June 14.	July 11.	August 16.	September 13.	October 10.	November 15.	December 11.
Number of Sample . .	34386	34739	35073	35363	35628	35997	36336	36800	37211	37526	37979	38278
Plants.												
DIATOMACEÆ:	512	170	34	28	87	113	49	35	22	7	57	122
Asterionella	47	6	3	9	29	18	0	13	0	0	15	68
Cyclotella	454	156	15	0	0	50	18	0	1	0	0	0
Synedra	0	0	5	3	30	0	0	0	1	3	5	54
CYANOPHYCÆ:	0	0	0	0	0	0	0	0	0	0	2	0
ALGÆ:	2	0	0	1	0	0	11	1	7	0	2	0
Animals.												
INFUSORIA:	24	12	10	24	506	1	0	0	1	0	0	3
Dinobryon	24	10	10	13	504	0	0	0	0	0	0	0
Euglena	0	0	0	11	1	0	0	0	0	0	0	0
VERMES:	0	0	1	3	0	0	0	0	1	0	1	0
MISCELLANEOUS.												
Zooglyca	3	3	5	3	5	5	3	5	5	3	5	5
Total	541	185	50	59	598	119	63	41	36	10	67	130

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1901.

MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	130,802,024	4,509,742	. . . . .	26,014	60.94	62.16
February	133,283,634	4,760,130	220,675	. . . . .	64.33	65.62
March	135,948,484	4,385,435	51,241	. . . . .	59.26	60.44
April	119,293,863	3,976,462	. . . . .	112,153	53.74	54.81
May	128,749,788	4,153,219	. . . . .	143,777	56.12	57.24
June	138,590,473	4,619,682	. . . . .	508,247	62.43	63.68
July	149,052,760	4,808,153	. . . . .	774,350	64.97	66.27
August	141,438,621	4,562,536	. . . . .	728,639	61.66	62.89
September	137,671,486	4,589,049	. . . . .	669,616	62.01	63.25
October	150,903,582	4,867,857	418,701	. . . . .	65.78	67.10
November	135,360,710	4,512,024	152,554	. . . . .	60.97	62.19
December	134,577,418	4,341,207	. . . . .	18,263	53.66	59.83
Totals and averages	1,644,672,843	4,505,953	. . . . .	173,918	60.89	62.11

Basis: Population, Lynn and Saugus, 74,000,

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1901.

MONTH.	GALLONS.				
	Breed's.	Birch.	Walden	Hawkes	Total.
January. .	27,948,375	. . . . .	18,436,250	91,893,375	138,278,000
February .	502,250	. . . . .	1,617,000	129,543,750	131,663,000
March . .	3,060,050	. . . . .	. . . . .	133,086,450	136,146,500
April . . .	51,587,672	4,544,750	18,692,275	47,768,058	122,592,755
May . . .	71,696,800	10,988,658	39,594,042	5,537,000	127,816,500
June . . .	13,190,392	125,785,858	. . . . .	. . . . .	138,976,250
July . . .	1,278,900	149,347,100	. . . . .	. . . . .	150,626,000
August. .	16,722,883	120,293,367	. . . . .	. . . . .	137,016,250
September	61,292,058	7,186,667	69,493,025	. . . . .	137,971,750
October. .	58,775,500	. . . . .	95,317,250	. . . . .	154,092,750
November	32,787,533	. . . . .	100,737,467	. . . . .	133,525,000
December	. . . . .	. . . . .	135,556,500	. . . . .	135,556,500
Totals .	338,852,413	418,146,400	479,445,809	407,828,633	1,644,263,255

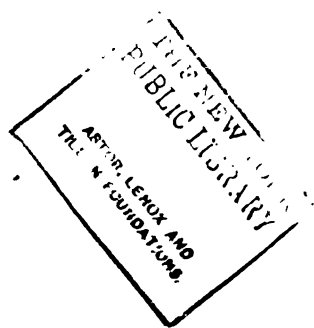
TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1901.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1				0.01		0.01			0.21			
2			0.12		1.02					0.63		0.18
3			0.10	0.56								1.40
4		0.75	0.17	0.13		0.06		0.11				
5										0.17		
6				1.80			0.30	0.00				
7				0.32		0.34		0.73				
8	0.04		0.09	0.02								
9			0.12	0.20	0.20		0.06					0.73
10	0.52		0.35	0.14	0.55			0.05	0.35			0.06
11	0.32	0.01	1.15				0.77		0.35		0.11	
12					0.11			0.03	0.33		0.15	
13			0.10		0.17				0.02	0.11	0.05	
14	0.06								1.52	0.01	0.01	0.42
15	0.14			0.45					0.22			0.05
16		0.02		0.20								
17	0.13						0.50	0.04	0.60	0.00		0.12
18							0.51		0.31		0.04	0.12
19					0.60			0.15			0.14	0.01
20			0.07	0.11	2.32				0.22			
21			0.55	0.35	0.04							
22		0.01		0.01		0.00						
23		0.21			0.10	0.34						0.44
24			0.13	2.50	0.73	0.02	0.55	2.13			2.01	0.15
25			0.52	1.02				0.02			0.07	0.04
26			1.92									0.55
27					0.27							0.13
28	0.01				0.03		1.55		0.25			0.42
29					0.02		0.00		0.31			1.22
30	0.11			0.27								0.55
31	0.14				0.04			0.10				
Total	1.47	1.00	5.84	5.40	7.11	1.73	4.62	3.45	3.20	2.52	2.61	5.16

* Snow.

Total for the year, 51.40.



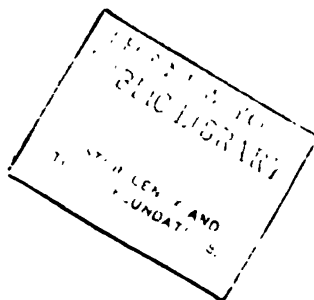


TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1901.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	..	..	..	..	0.02	..	..	0.20	..	0.03	..
2	..	..	0.08	..	0.97	..	..	..	..	0.67	..	0.20
3	..	..	0.30	1.45	..	..	..	..	..	..	..	*1.33
4	..	*0.45	*0.25	0.13	..	0.06	..	..	..	..	..	..
5	..	..	..	1.48	..	..	..	..	..	0.15	..	..
6	..	..	..	0.09	..	..	0.25	0.16	..	0.02	..	..
7	..	..	..	..	..	0.38	..	0.69	..	..	..	..
8	..	..	0.09	..	..	..	..	..	..	..	..	..
9	..	..	0.16	0.18	0.31	..	0.09	..	..	..	..	0.59
10	S&R	..	0.31	0.12	0.58	..	..	0.05	0.30	..	S&R	..
11	R .74	..	1.23	..	..	..	0.79	..	0.35	..	0.19	..
12	..	..	..	..	0.01	..	..	0.03	0.20	..	0.32	0.02
13	..	..	0.04	..	0.26	..	..	..	0.08	0.18	*0.04	..
14	..	..	..	..	..	..	..	..	..	1.63	..	0.24
15	S&R	..	..	0.47	..	..	..	..	0.20	..	..	0.83
16	0.04	..	..	0.23	..	..	..	..	0.32	..	..	..
17	*0.09	..	..	..	..	..	0.72	0.03	0.11	0.09	..	0.10
18	..	..	..	..	0.61	..	0.50	..	0.30	..	..	..
19	..	..	..	..	2.21	..	..	0.13	0.22	..	*0.11	..
20	..	..	0.06	0.11	0.02	..	..	..	..	..	..	..
21	..	..	0.85	0.20	..	..	..	..	..	..	..	..
22	..	..	..	0.08	0.12	1.09	..	..	..	..	..	..
23	..	..	..	0.04	..	0.39	..	..	..	..	..	0.48
24	.07	*0.18	..	..	..	..	0.65	2.05	..	..	S&R	0.02
25	..	..	0.11	2.34	0.70	..	..	..	..	..	1.91	..
26	..	..	0.58	0.95	..	..	..	..	..	..	*0.15	S&R
27	..	..	1.75	..	0.25	..	..	..	..	..	..	0.73
28	..	..	..	..	0.64	..	..	..	..	..	..	*0.09
29	..	..	..	..	0.02	..	1.43	..	0.23	..	..	0.30
30	*0.08	..	..	..	0.01	..	0.05	..	0.30	..	..	1.57
31	*0.10	..	..	0.27	..	..	..	0.12	..	..	..	0.24
Total	1.49	.63	5.71	3.23	6.71	1.94	4.48	3.26	2.87	2.74	2.75	6.74

* Snow.

Total for the year 47.55.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1901.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Glen Lewis Pond.
January 5	21.7	14.6	6.6	10.9	17.5
January 12	21.2	14.10	9.6	11.4	15.10
January 19	21.5	14.8	9.7	11.10	15.10
January 26	21.9	13.9	9.7	12.4	14.2
February 2	22.3	13.9	9.8	11.5	13.5
February 9	21.4	13.11	9.5	12.	12.6
February 16	20.10	13.11	9.5	12.4	11.9
February 23	20.3	14.	9.8	12.6	11.3
March 2	20.5	14.1	9.9	12.9	10.9
March 9	22.10	15.	10.9	13.7	11.4
March 16	21.3	16.	10.11	14.2	12.1
March 23	23.0	16.6	11.2	14.5	12.3
March 30	23.5	18.7	12.5	15.11	15.2
April 6	23.4	19.11	13.1	16.10	17.
April 13	25.3	20.6	14.5	17.5	17.
April 20	26.	20.2	16.6	17.	17.2
April 27	26.2	20.9	16.10	17.6	15.6
May 4	26.	20.6	21.6	17.6	18.6
May 11	26.	20.4	22.7	17.3	18.6
May 18	26.	20.4	22.7	17.3	18.6
May 25	26.4	20.10	21.3	17.6	18.6
June 1	26.2	20.4	23.	17.4	18.6
June 8	26.	20.6	22.2	17.4	18.6
June 15	26.	20.2	21.3	17.3	18.4
June 22	25.9	20.6	19.5	17.4	17.9
June 29	25.8	20.5	18.8	17.3	17.11
July 6	25.3	20.1	17.3	16.10	17.10
July 13	25.	20.	15.5	17.6	17.5
July 20	24.9	20.	14.	16.10	17.
July 27	24.7	20.	12.7	16.10	17.
August 3	24.6	20.	12.	16.11	17.6
August 10	24.1	20.	10.4	16.9	17.6
August 17	24.	19.10	8.3	16.6	17.6
August 24	23.6	19.5	7.	16.7	18.
August 31	23.2	18.7	7.	16.6	17.11
September 7	22.10	17.5	7.	16.5	17.10
September 14	22.8	16.5	7.	16.2	17.9
September 21	22.6	15.11	8.6	13.10	14.
September 28	22.4	15.11	7.	13.6	13.
October 5	22.11	15.11	8.5	11.10	17.10
October 12	22.	15.11	7.6	11.6	17.10
October 19	21.10	15.6	7.2	10.11	18.
October 26	21.9	14.	7.9	10.	15.
November 2	21.9	13.6	6.6	10.5	13.
November 9	21.4	12.3	5.	12.4	7.2
November 16	21.5	12.3	7.	12.4	7.
November 23	21.6	11.10	6.	12.	7.
November 30	22.	11.7	10.7	9.5	7.3
December 7	22.3	12.	10.	9.7	7.4
December 14	22.6	12.4	9.4	10.	8.3
December 21	24.3	13.5	8.6	10.9	8.3
December 28	24.9	14.6	8.4	11.9	10.5
January 4	25.1	16.8	5.1	12.4	13.4

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1901.

STREET.	LOCATION.
Boston	On east line of Park street, 16 feet south from north line of Boston street.
Dixon.....	On south line of Broadway west from east line of Dixon street.
Essex	On south line of Eastern avenue, 18 feet, 6 inches west from east line of Essex street.
Franklin	On south line of Boston, 12 feet east from west line of Franklin street.
Kirtland.....	On north line of Boston, 12 feet west from east line of Kirtland street.
North Federal	On north line of Boston, 8 feet, 6 inches west from east line of North Federal street.
Sewall	On south line of Eastern avenue, 17 feet east from west line of Sewall street.
Springvale avenue	29 feet east of the cemetery gate.
Temple	On east line of Broadway, 14 feet south from north line of Temple street.
Wheeler.....	On east line of Church, 19 feet south from north line of Wheeler street.
Wolcott road.	On south line of Ocean, 20 feet west from east line of Wolcott road.

TABLE VII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE.

KIND.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{8}$ in.	2 in.	3 in.	4 in.	Total
Trident	628	682	69	5	5	...	...	1,389
Thomson	173	364	94	17	3	1	1	653
Lambert	136	143	6	2	8	...	...	295
Hersey	85	60	2	1	...	...	...	148
Ball and Fitts	35	32	17	...	...	...	...	84
Union	5	23	8	8	9	...	13	66
Nash	54	15	1	...	1	...	...	71
Niagara	35	32	1	...	...	...	...	68
Columbia	45	5	1	...	...	...	...	51
Crown	2	6	4	2	...	...	...	14
Empire	11	10	...	2	2	...	1	26
All others	3	8	5	4	6	2	...	28
Motors . . . . .	...	...	...	...	...	...	...	...
Totals	1,212	1,380	208	41	34	3	15	2,893

TABLE VIII.

SHOWING CONSUMPTION IN GALLONS OF ESTIMATED AND METERED QUANTITIES.

Domestic, non-metered	978,255,559
Manufacturing, metered	240,000,000
Domestic, metered	150,000,000
Loss in registration, 5 per cent. estimated .	1,950,000
Loss in distribution, 10 per cent. estimated pumpage	164,467,284

CITY PURPOSES.

Street sprinkling	42,000,000
Watering troughs	32,000,000
Schools	13,000,000
Fires	5,000,000
Sewers	3,000,000
Highway Department	3,000,000
Engine houses	2,000,000
Fountains	2,000,000
City Hall	1,000,000
Police Station	1,000,000
Health Department	1,000,000
Cemeteries	500,000
Public Library	500,000
Water Department	500,000
All others	500,000
	<hr/>
	110,000,000
Total	1,644,672,843

TABLE IX.

SHOWING TOTAL LENGTH AND SIZES OF SERVICES LAID IN LYNN AND SAUGUS.

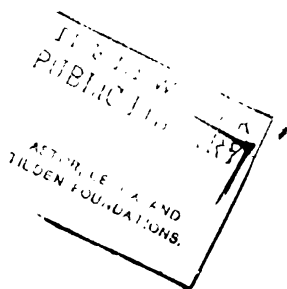
	4 in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	Total.
Lynn	34	84-6	574	3,011	2,541	79	6,323-6
Saugus . . . . .	.....	.....	.....	617	1,011	.....	1,623
Total	34	84-6	574	3,628	3,552	79	7,951-6

TABLE X.

SHOWING THE SIZE AND TOTAL LENGTHS OF IRON PIPE LAID IN 1901.

WHERE LAID.	16 in.	12 in.	10 in.	6 in.	4 in.	Total.
Alice*					307	307
Barney and Dixon				396		396
Bacheller†					180	180
Boston*			2,250			2,250
Chestnut*				1,207		1,207
Church*				1,453		1,453
Centre, Marion, Federal	1,008					1,008
Eastern avenue†				319		319
Empire*				720		720
Essex*				1,894		1,894
Marion and Kirtland*						520
Minot court					159	159
Sewall†						42
Springvale avenue†				42		42
Temple					453	453
Western avenue*			889	360		1,249
Whitney†					144	144
Wolcott road					418	418
	1,008	226	3,139	6,511	1,661	12,545

	MILES.	FEET.
*Total length relaid		10,374
†Total length extended		1,138
Total length new streets		1,333
Total length system	131	4,290
Total in Swampscott		1,788
Total in Saugus	18	3,652



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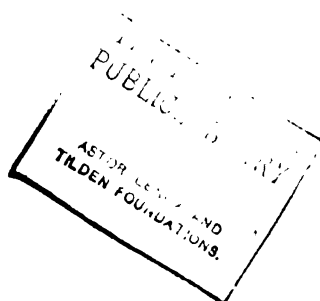
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SUMMARY OF STATISTICS.

Report of 1901.

LYNN WATER WORKS, LYNN, MASS.

Population by census of 1900.

Lynn and Saugus,

73,613

Date of construction,

1870 to 1902

Owned by

City of Lynn

Source of supply,

Five artificial storage basins formed by constructing dams across the valleys of four brooks, Saugus river taken direct.

Mode of supply,

By gravitation to the pump well, and pumped thence to a distributing reservoir at an elevation of 177 feet above mean high tide by one Leavitt engine, built by J. P. Morris & Co. of Philadelphia, of 5,000,000 daily capacity, and one Loretz engine of 11,500,000 daily capacity, one Loretz high service engine of 10,000,000 daily capacity.

1. Kind of coal used,

Georges Creek

2. Cost of Coal,

3. Coal consumed for the year, in pounds,

Leavitt and High.	Loretz.
40,400	2,625,400

4. Total pumpage for the year, in gallons,

19,582,505 1,624,680,750

	Leavitt and High.	Loretz.
5. Average dynamic head against which the pump works,		
	165.49	157.46
6. <i>a.</i> Number of gallons pumped per pound of coal (3),		
	484.07	618.08
<i>b.</i> Number of gallons raised 100 feet per pound of coal (3),		
	802.12	974.36
7. Duty, in foot pounds per 100 pounds of coal, no deductions.		
	66,899,779	81,265,994
Duty = $\frac{\text{gallons pumped (4)} \times 8.34 \times 100 \times \text{dynamic head (5)}}{\text{total coal consumed (3)}}$		

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$12,000.

8. Per million gallons raised against dynamic head (7) into reservoir,	
	\$7.02
9. Per million gallons raised one foot high (dynamic),	
	4.20 cents.

COST OF PUMPING, FIGURED ON TOTAL MAINTENANCE, VIZ. :
\$145,630.

10. Per million gallons raised against dynamic head (7) into reservoir,	
	\$85.10
11. Per million gallons raised one foot high (dynamic)	
	50.90 cents.

FINANCIAL.

MAINTENANCE.

RECEIPTS.	EXPENDITURES.
<i>From Consumers:</i>	
A. Water rates, domestic,	AA. Management and repairs, \$76,862.00
B. Water rates, manufacturing,	BB. Interest on bonds, 72,596.24
C. Net receipts, for	CC. Total maintenance, \$149,458.24
D. Repairs and sundries,	DD. Balance carried to sinking fund, 52,097.05
E. Premium on bonds,	
F. Gross receipts from all sources,	EE. Total,
\$201,555.29	\$201,555.29

PUBLIC WATER BOARD REPORT.

CONSTRUCTION.

RECEIPTS.		EXPENDITURES.	
F. From balance of 1900,	\$16,053.89	FF. New 30-inch conduit,	\$4,189.50
G. Pipes, meters and labor,	1,842.41	GG. Extension of main lines,	1,641.19
H. Loans,	25,000.00	HH. Extension of service pipes,	4,906.74
		II. Hawkes Pond,	5,015.20
		JJ. Engineering,	675.00
		KK. Total construction for year,	\$16,427.63
		LL. Balance,	26,468.67
I. Total,	\$42,896.30	MM. Total,	\$42,896.30

L. Net cost of works to date, \$2,487,371.15.

J. Bonded debt, Dec. 31, 1901, \$1,775,300.00.

K. Value of sinking fund, \$641,434.09.

L. Rate of interest, 3½, 3¼, 4, 4½, 5.

CONSUMPTION.

Estimated population to date (Lynn and Saugus),	74,000
Estimated population supplied,	72,520
Total number of gallons consumed for the year,	1,644,672,843
No. of gallons metered,	390,000,000
Average daily consumption in gallons,	4,505,953
Gallons per day to each consumer.	62.11

DISTRIBUTION.

Kind of pipe used,	Wrought iron, cement-lined, and cast-iron.
Size,	From 2 to 20 inches diameter.
Extended,	2,471 feet.
Total now in use,	Lynn, Saugus Swampscott, 131 miles, 4,290 feet.
Number of leaks for the year,	87
Hydrants added,	7
Hydrants now in use,	959
Gates added,	11
Gates now in use,	977
Range of pressure of city for day and night,	45 to 60 pounds.

SERVICES.

Kind of pipe used,	Cement-lined and lead-lined
Size of pipe used,	$\frac{3}{4}$ to 4 inches in diameter.
Extended,	31
Discontinued,	9
Numbered of services added,	184
Number of services discontinued,	9
Number of services now in use,	12,722
Total length of services,	97 miles, 3,176 feet
Number of services added in Saugus,	34
Number of services now in use in Saugus,	967
Length of services added in 1900,	1,628
Total length of services in Saugus,	9 miles, 1,458 feet
Meters added,	322
Meters now in use,	2,893

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ANNUAL REPORT

OF THE

PUBLIC WATER BOARD

OF THE

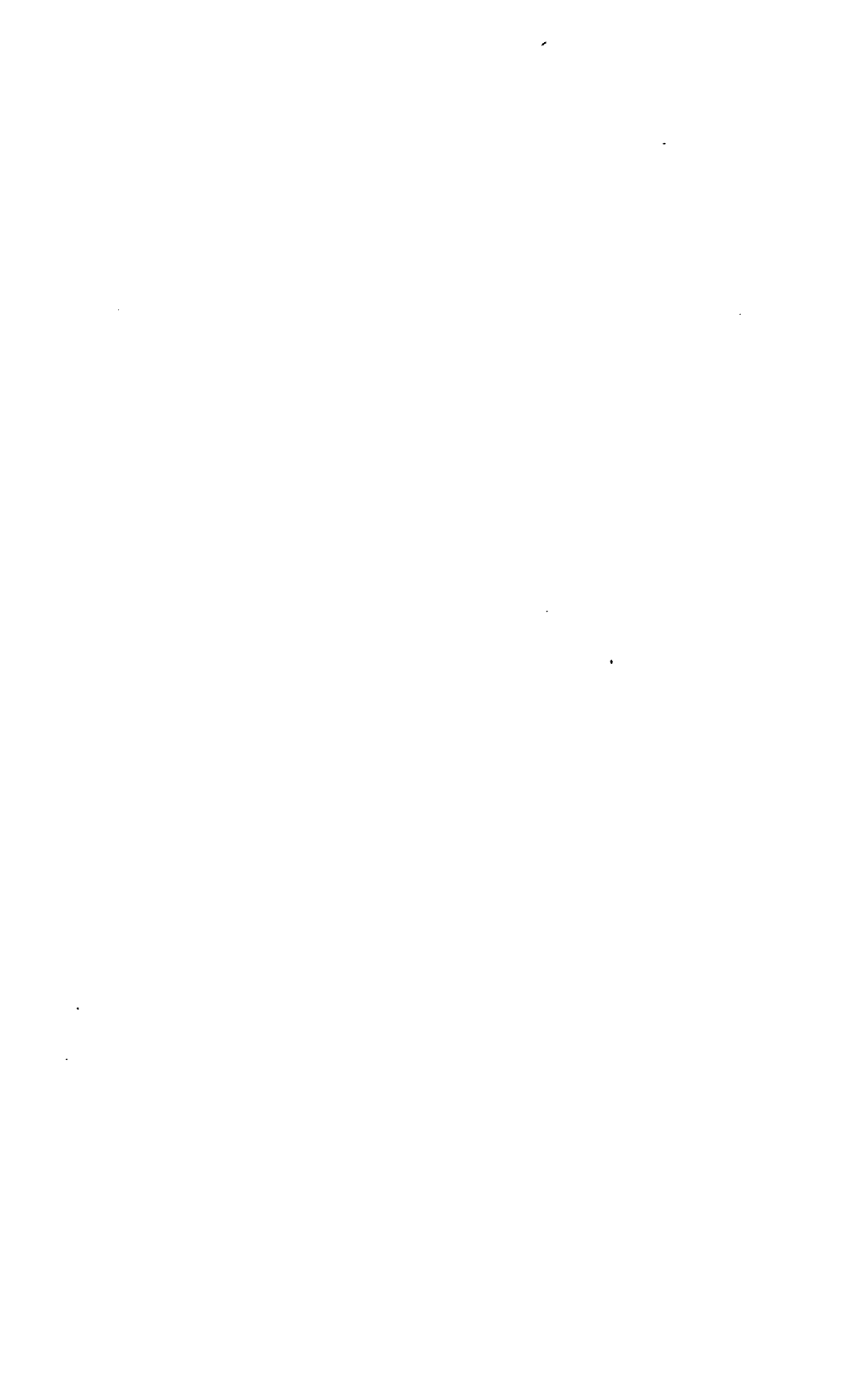
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1902.



LYNN, MASS.
WHITTEN & CASS, PRINTERS
1903.

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ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1902.



LYNN, MASS
WHITTEN & CASS, PRINTERS

1903

PUBLIC WATER BOARD FOR 1903.

THOMAS P. NICHOLS, for one year.

W. B. LITTLEFIELD, *Pres.*, for two years.

S. W. DEARBORN, for three years.

JAMES BURNS, for four years.

C. E. SPRAGUE, for five years.

OFFICERS FOR 1902.

C. E. SPRAGUE,
For one year.

THOMAS P. NICHOLS,
For two years.

WILLIAM B. LITTLEFIELD, *Pres.*
For three years.

S. W. DEARBORN,
For four years.

JAMES BURNS,
For five years.

Superintendent and Clerk, D. A. SUTHERLAND.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, GEORGE H. VENN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHEELOCK.

Foreman of Meters and Repairs, W. H. McLAIN.

INSPECTORS.

WINSLOW J. ROWELL,
J. FRANK POOL,

W. B. MOULTON,
JOHN CHAMBERLAIN.

CLERKS.

LILLIAN M. ATTWILL,
Analyst.

M. E. RANKINS.

ANNUAL REPORT.

LYNN, MASS., December 31, 1902.

To the Honorable Mayor and City Council:

GENTLEMEN,—The Public Water Board in conformity with the charter and ordinances have the honor to present this thirty-first annual report, together with the reports of the Superintendent and Registrar.

Our Source of Supply.

Our present system comprises:

Ponds.	Acres.	Capacity in Gallons.
Breed's	54.85	262,563,340
Birch	82	381,062,901
Glen Lewis	36	120,475,126
Hawkes	75	300,000,000
Walden	128	403,163,826
A total storage of		<u>1,467,265,193</u>

In connection with these sources we have a conduit from Saugus River to Hawkes Pond having a daily capacity for delivering about 30,000,000 gallons. The water-shed, from which the city has a right to take the water which contributes to this supply, contains less than 50 inhabitants to the square mile and is absolutely free from all direct sewage contamination.

Our total consumption this year was 1,709,855,000 gallons; an increase of 65,182,157 over the preceding year. The consumption of water the past year has been 242,589,807 gallons in excess of our storage capacity.

On December 15, 1901, the several ponds contained 541,115,216 gallons. On the same date of 1902 the ponds contained 287,935,112

gallons, showing a decrease of water in store of 253,180,104 gallons.

If the rainfall the past year had been as light as the rainfall in the year 1899, Lynn would have been dangerously near a water famine. The above figures prove that an appropriation for an increased storage capacity was not granted before it was necessary.

New Pumping Station.

The new pumping station was designed by and built under the supervision of A. J. L. Loretz & Son. The building was contracted for by Edward D. Dearborn for the mason work, and Frank G. Kelley for the carpenter work. The building is of brick with a chimney 100 feet high. The dimensions of the building are 114 by 40 feet; it is located on Walden Pond road near Walnut street and is practically fireproof.

The engines, pumps and special castings were furnished by A. J. L. Loretz & Son, also designed by them.

Much praise and great credit are due Mr. Loretz and son for the able manner in which they have assembled the different parts to completion. When we realize that the variation of a fraction of an inch would cause sufficient friction to prevent starting the engine, we must acknowledge that no man could carry through such a task successfully unless trained by long years of experience for its performance.

The work was completed December 30, 1902. By invitation from Mr. Loretz and son the City Government inspected the work and witnessed the starting of the engine.

December 30, 1902, at 3.15 P. M. President Littlefield turned on the steam and started the engine, running the speed up to 34 revolutions per minute.

On account of the inadequate supply of water the engine did not run its full speed, which is 45 revolutions per minute. However, the working parts were so accurately adjusted that the engine run with the ease of an engine which had been in operation for a long period. At a speed of 45 revolutions per minute the engine will pump 30,000,000 gallons of water in 24 hours.

The pumps are connected with 48-inch pipes through which it receives its supply from Hawkes Pond through the canal to the

intake well and pumped through the 48-inch pipe to Birch Pond. Also through the 48-inch pipe to fill Walden Pond, which is connected with a 30 and 36-inch pipe.

Intake Well.

An intake well and house have been built in connection with the pumping station. The house is of brick and the base comprises several large arches through which a large quantity of water may flow to supply the pumps. Each arch is provided with double screens, coarse screens on the outside of the arches and fine screens on the inner side. Also a fine screen over the main arch through which the water flows direct to the pumps through the 48-inch pipes.

The precaution is taken to prevent leaves or any deposit whatever passing through or reaching the pumps.

The dimensions of the well are 50 by 100 feet. The bottom of the well is built of concrete with walls of stone and slopes paved.

At the inflow of the canal a loose stone wall has been constructed and fine cobblestones were placed back of the wall to act as a filter to hold back any sediment or deposit that may flow through the canal.

Grubbing in Walden and Glen Lewis Ponds.

Grubbing was commenced April 20, 1902, along the shores of Walden and Glen Lewis Ponds and many acres were cleared of soil and stumps. About 10,000 stumps were removed by the aid of the stump pulling machine.

As soon as the water was drawn from Walden Pond, work was commenced and stumps were removed from the bottom of the pond and gravel was spread upon the surface from 12 to 15 inches in depth.

The experience we have had in the past covering the vegetable matters in Walden Pond has been most satisfactory.

In the year 1894 we covered an area of 10 acres of Walden Pond with gravel, over a deposit of vegetable matter, and in the following year we covered an area of 13 acres, making 23 acres in all.

After an elapse of nine years we find it in as good condition in regard to staying qualities as when first completed.

The method of covering deep deposits of vegetable matter with gravel is adopted by the Metropolitan and other water works.

The work of grubbing was continued until early in December, when it was necessary to stop on account of freezing weather. Work will be resumed next season as soon as the water is drawn from the ponds, with a desire to complete the work before winter.

Walden Pond Dam.

The contract for building the dam was awarded to Frederick E. Shaw, of Providence, R. I. The work on the foundation is well under way, but the progress has been slow on account of the large amount of quicksand encountered after removing the soil and gravel from the surface.

Owing to the deep deposit of quicksand, it has been necessary to drive sheeting piles to a depth of 17 to 24 feet, at a distance of 300 to 400 feet. Two sets of piles were driven and the core wall built between the piles.

This precaution was taken to prevent the percolation of water under the dam. The dimensions of the piles used were 6-inch grooved sheeting piles with hard pine splines, making the sheeting watertight. A pile driver was used and the piles were driven to a hard foundation.

The quicksand was much deeper than the engineer anticipated and recommended this method as being the best, and less expensive than removing the quicksand.

The work has been carried forward as speedily as could be expected under existing circumstances.

A portion of the core wall has been completed to the surface, and should the weather prove favorable the next two months, we hope to have the remaining portion of the wall below the dam completed to the surface that we may be able to fill Walden Pond for summer use.

It is essential that Walden and Glen Lewis Ponds be full in the spring to supply the city through the season. In fact it is necessary that all the ponds should be full the first of May.

Roads.

A portion of the new road from Walden Pond road to a point opposite the mouth of Penny Brook has been completed. In the early spring work will be resumed and pushed forward to completion, which will afford one of the pleasantest drives in our city, and scenery of a picturesque nature.

The road building and grubbing has been done by day labor, employing all the able bodied men that applied for work.

At times we were unable to secure men who were able to perform the work in a satisfactory manner.

Statement.**WATER DEBT.**

Amount of debt, December 19, 1901 . . .	\$1,775,300 00	
Bonds issued in 1902	400,000 00	
	<hr/>	
Amount of debt, December 19, 1902 . . .		\$2,175,300 00

SINKING FUNDS.

Amount of funds, December 19, 1901 . . .	\$489,337 04	
Received from Treasurer in year 1902 . . .	52,097 05	
Earnings of sinking funds in year 1902 . . .	18,335 76	
	<hr/>	
Amount in hands of Commissioners, December 19, 1902	\$559,769 85	
Amount in hands of Treasurer, December 19, 1902; net income of Water Department for year 1902	83,027 59	
	<hr/>	
		642,797 44
		<hr/>
Net water debt, December 19, 1902 . . .		\$1,532,502 56

Treasurer's Statement for the Year Ending December 19, 1902.

RECEIPTS.

From water rates	\$211,333 28	
From premiums on loans	23,060 25	
From accrued interest on bonds sold	1,115 62	
	<hr/>	\$235,509 15

EXPENDITURES.

For maintenance	\$73,232 81	
For interest	79,248 75	
	<hr/>	152,481 56
Net income for year ending Dec 19, 1902		<hr/> \$83,027 59

Land.

	Acres.
Abigail A. Foster	32
Byron S. Hone	12 $\frac{1}{10}$
H. R. Philpot	1 $\frac{1}{2}$

Respectfully submitted,

WILLIAM B. LITTLEFIELD, *Pres.*
 THOMAS P. NICHOLS,
 JAMES BURNS,
 CHARLES E. SPRAGUE,
 STEPHEN W. DEARBORN.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
 Lynn, Mass., January 1, 1903. }

To William B. Littlefield, President:

SIR,—I herewith present the financial condition of the department for the year ending December 31, 1902.

RECEIPTS FOR 1902.

Fixture rates	\$114,607 63	
Meter rates	87,865 14	
Miscellaneous	7,203 19	
Additional rates	1,555 29	
Fines	51 40	
Total revenue	<u> </u>	\$211,282 65
Extra pipe		2,310 87
		<u> </u>
Total receipts as per cash book		\$213,593 52

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year		\$211,282 65
Amount outstanding, fixture rates	\$18,843 50	
Amount outstanding, meter rates	6,828 89	
Amount outstanding (not due), meter rates	20,385 45	
	<u> </u>	46,057 84
		<u> </u>
		\$257,340 49
Deduct amount due January 1, 1902		41,648 46
		<u> </u>
Revenue for 1902		\$215,692 03
Revenue for 1901		203,078 45
		<u> </u>
Increase		\$12,613 58

STATEMENT OF NET EARNINGS FOR 1902.

Revenue	\$215,692 03
EXPENSES.	
Interest	\$79,248 75
Maintenance	69,243 46
Rebate to Saugus	4,653 77
	<hr/>
	153,145 98
Net earnings	<hr/>
	\$62,546 05

EXPENDITURES FOR THE YEAR 1902.

MAINTENANCE.	
Mains	\$17,920 32
Pumping expenses	11,130 62
Salaries and expenses	9,379 78
Meters	7,644 65
Miscellaneous	6,868 09
Services	5,533 31
Stable and shop	3,395 58
Glen Lewis Pond	3,319 31
Canal system	2,489 74
Taxes	410 48
Engine and boilers	391 92
Damages	336 59
Birch Pond	335 26
Engine house	87 81
	<hr/>
	\$69,243 46
CONSTRUCTION.	
Waden Pond (cleaning)	\$55,148 57
Walden Pond dam	45,906 10
Engine and setting	41,980 90
Engine house	21,244 15
Pipes, gates and well chamber	15,193 83
Services	7,350 23
Mains	3,804 77
Land	2,022 00
	<hr/>
	\$192,650 55
Less amount received for extra pipe	2,310 87
	<hr/>
	\$190,339 68

STATEMENT.

SHOWING COST OF WORKS TO JANUARY 1, 1903.

Mains, hydrants and gates	\$882,706 22
New supply and land	338,595 27
Services and courts	318,129 21
Walden and Glen Lewis Ponds	287,956 09
Engines and boilers	140,327 29
Hawkes Pond	161,036 53
Reservoirs and land	131,581 49
Birch Pond and land	93,471 84
Engine house pump and conduit, Walden Pond,	78,418 88
Engine house and land	57,562 39
Breed's Pond and land	57,135 28
Pipe conduits and land	81,289 39
Hawkes Pond canal	47,947 33
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,274 07
Highland service	12,431 17
Engineering	11,157 95
Tubular wells	9,470 02
Workshop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,825,139 94
Less amount received for pipe	147,429 11
	<hr/>
Total net cost	\$2,677,710 83

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	11,873	
Number of services in Saugus	1,000	
Total	<hr/>	12,873
Number put in during the year (Lynn)	188	
Number put in during the year (Saugus)	34	
Total	<hr/>	222
Number extended during the year (Lynn)	26	
Number extended during the year (Saugus)	2	
Total	<hr/>	28
Renewed	68	
Number discontinued	21	
Number not in use	37	
Turned on (new services)	101	
Turned on (reoccupied)	163	
Turned on (repairs)	6	
Shut off (for vacancy)	139	
Shut off (for non-payment)	16	
Shut off (for repairs)	23	

STATEMENT.

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
 ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
 CONTAINED IN THE SAME, TOGETHER WITH THE
 NUMBER OF FIRE HYDRANTS, DEC. 31, 1902.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	11,868	937	12,805
Stores and shops	1,225	46	1,271
Factories	200	3	203
Offices	501	16	517
Restaurants and saloons	77	..	77
Schoolhouses	59	7	66
Churches	32	5	37
Bakeries	30	..	30
Laundries	19	..	19
Engine houses	11	3	14
Families	16,684	1,031	17,715
Boarding-houses	225	2	227
Faucets	31,227	1,841	33,068
Water-closets	14,247	450	14,697
Bath tubs	5,405	347	5,751
Hose bibs	3,220	164	3,384
Urinals	187	8	195
Heaters	919	65	984
Stationary engines	165	7	172
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	29	..	29
Stand-pipes for fire purposes	17	1	18
Stand-pipes for water-carts	76	..	76
Sewer connections	25	..	25
Automatic sprinklers	100	3	103
Hydrants	805	158	963
Hydrants for car sprinklers	43	1	44

STATEMENT.

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	\$8,989 00
From January 1, 1872, to January 1, 1873	27,568 15
From January 1, 1873, to January 1, 1874	47,992 61
From January 1, 1874, to January 1, 1875	53,545 61
From January 1, 1875, to January 1, 1876	52,553 26
From January 1, 1876, to January 1, 1877	60,807 12
From January 1, 1877, to January 1, 1878	64,002 50
From January 1, 1878, to January 1, 1879	67,570 14
From January 1, 1879, to January 1, 1880	73,949 80
From January 1, 1880, to January 1, 1881	79,635 12
From January 1, 1881, to January 1, 1882	80,967 76
From January 1, 1882, to January 1, 1883	94,419 52
From January 1, 1883, to January 1, 1884	98,893 54
From January 1, 1884, to January 1, 1885	114,903 86
From January 1, 1885, to January 1, 1886	110,089 11
From January 1, 1886, to January 1, 1887	116,375 70
From January 1, 1887, to January 1, 1888	123,507 73
From January 1, 1888, to January 1, 1889	134,480 27
From January 1, 1889, to January 1, 1890	141,865 53
From January 1, 1890, to January 1, 1891	154,788 27
From January 1, 1891, to January 1, 1892	171,744 85
From January 1, 1892, to January 1, 1893	188,979 88
From January 1, 1893, to January 1, 1894	177,803 56
From January 1, 1894, to January 1, 1895	176,655 50
From January 1, 1895, to January 1, 1896	185,572 88
From January 1, 1896, to January 1, 1897	190,531 33
From January 1, 1897, to January 1, 1898	183,711 97
From January 1, 1898, to January 1, 1899	186,658 35
From January 1, 1899, to January 1, 1900	193,699 01
From January 1, 1900, to January 1, 1901	199,003 54
From January 1, 1901, to January 1, 1902	203,078 45
From January 1, 1902, to January 1, 1903	215,692 03

\$3,980,094 96

FUNDED WATER LOAN.

When Payable.		Rate Per Cent.	Amount.
March	1, 1903	4	\$8,000
May	1, 1904	3½	7,300
January	1, 1905	5	200,000
January	1, 1905	4	150,000
May	1, 1905	3½	66,500
December	1, 1905	3½	5,000
November	1, 1913	4	20,000
November	1, 1913	3½	31,000
March	15, 1914	4	50,000
December	1, 1914	4	20,000
December	1, 1915	3½	6,000
April	1, 1916	3½	2,000
May	1, 1916	3½	24,500
September	1, 1916	4	10,000
October	1, 1916	4	9,000
February	1, 1917	3½	6,500
June	1, 1917	3½	3,500
July	1, 1917	4	7,500
August	1, 1917	4	5,000
October	1, 1917	4	2,000
November	1, 1917	4	6,500
April	1, 1918	4	15,000
June	1, 1918	4	10,000
July	1, 1918	4	50,000
April	1, 1919	4	100,000
July	1, 1919	4	110,000
January	1, 1920	4	35,000
April	1, 1920	4	150,000
April	1, 1921	4	50,000
October	1, 1921	4	25,000
January	1, 1922	4	50,000
July	1, 1922	4	25,000
April	1, 1923	4	40,000
July	1, 1925	4	165,000
July	1, 1926	4	50,000
September	1, 1927	4	25,000
July	1, 1928	4	25,000
October	1, 1928	4	10,000
July	1, 1929	4	25,000
January	1, 1930	4	25,000
October	1, 1930	4	25,000
Note (on demand)		4	100,000
July	1, 1931	4	25,000
January	1, 1932	3½	75,000
April	1, 1932	3½	325,000
			<hr/>
			\$2,175,300

REPORT OF SUPERINTENDENT.

To the Public Water Board:

GENTLEMEN,—In compliance with the city ordinance, I herewith present the annual report of the Superintendent for the year ending December 31, 1902.

Water Supply.

The following ponds have contributed the water supply during the past year :

Ponds.	Gallons.	Gallons.
Breed's	357,995,429	
Birch	357,922,541	
Walden	578,858,438	
Glen Lewis	128,392,250	
Hawkes	286,686,342	
Total of		1,709,855,000
Total consumption, 1901		1,644,263,255
Increase		65,591,745

The increase in consumption the present year over 1901 was 65,591,745 gallons.

On November 1, 1902 there was stored in the several ponds as follows: Walden and Glen Lewis Ponds were empty; Breed's Pond contained 124,311,870 gallons; Birch Pond, 27,706,548 gallons; Hawkes Pond, 174,802,262 gallons; a total of 326,820,680 gallons.

Total storage November 1, 1901, 512,509,185.

The above figures show 185,688,505 gallons less in store on November 1, 1902 than on November 1, 1901.

The analysis of water from the several ponds made in the laboratory the past year, and those by the State Board of Health, show the water to be of better quality than any preceding year.

The amount of chlorine in the several ponds from which our supply has been drawn the past year, will average .38 or .06 below normal for Lynn, which is .44.

The above figures show the ponds are free from any sewage contamination.

Increased Storage Capacity.

Great interest has been manifested by the members of the Water Board and much time has been given to the work of increased storage capacity, of which the public have little knowledge.

Frequent visits to the works have been made by the members of the Board who have expressed themselves as being well pleased with the capable manner in which the work is being carried forward.

The President of the Board has visited the works nearly every day since the work was begun. His frequent visits have made him familiar with every detail of the work, which has enabled him to save much expense by his methods and suggestions in connection with the work, and he deserves much credit for the able manner in which he has managed the financial part in connection with the Board. It is the desire of the Board to complete the work within the limits of the appropriation.

The city and Water Department are fortunate that the President has been able to give so much of his valuable service to the work.

Pumping Station.

The new pumping station has been completed with a pumping capacity of 30,000,000 gallons per 24 hours.

The new pumping plant is an important feature in connection with increased storage supply.

When the plans of the engineers, Loretz & Son, are completed, which requires pipes to be laid to connect the new pumping station with the old pumping station, the Water Department will be able to pump water direct to Walden, Birch and Breed's Ponds, also to reservoir and stand-pipe.

The department will be unable to accomplish this portion of the plan the coming season, but will complete the work in the near future.

The supply for filling Birch and Walden Pond will be drawn from Hawkes Pond, which receives its supply from Hawkes Brook and Saugus River. The river is connected with Hawkes Pond by canal with a capacity of 30,000,000 gallons per day.

The city has the right to flow a large meadow on the borders of Saugus River from October 20 to April 20 and the supply will be drawn from Hawkes Pond when the freshet flow of water in the river is sufficient to insure a full pond to draw from.

Hawkes Pond is connected with the new pumping station by a canal of sufficient capacity to supply the pumps.

If the water which runs to waste in Saugus River can be stored Lynn will have an abundant supply for many years.

Walden Pond Dam.

The work on the dam has been somewhat delayed on account of difficulties encountered in construction of the work. A portion of the core wall has been completed to the surface and the remaining portion below the dam will be completed before the first of April, when we will proceed to fill Walden Pond with water for use in the coming season. The work has been under the supervision of L. A. Taylor and George I. Leland, civil engineers.

Grubbing.

The work of grubbing has been of a difficult nature owing to the deep deposits of vegetable matter found in the bottom of the ponds, but notwithstanding the difficulties encountered the work has been successfully carried forward under the supervision of H. G. Littlefield, and during the year 1903 the work will be completed.

New Road.

A portion of the new road has been completed and in the early spring it will be carried forward to completion.

New Mains.

During the year 3,940 feet of new mains and extensions have laid in the following streets: Light, Ray, Pitkin, Aborn court,

Atlantic View avenue, Maple, and Wilson court. Extensions have been laid in Coburn, Eastern avenue, Fayette, Fuller and Rock avenue.

Mains Relaid.

During the year 13,512 feet of cement-lined pipe was taken up and replaced with cast-iron pipe mains in the following streets: Bassett, Burchstead place, Chestnut (from Maple to Silsbee avenue), Cherry, Fayette court, High Rock (from High Rock avenue to Herbert), Nahant (from Broad to Ocean), Light (from Summer to Hathaway), Nichols, Sagamore (from Newhall to Washington), Shepard (from Boston & Maine Railroad to South Common street), and Washington (from Laighton to Liberty).

During the year 15 new gates have been set in connection with new mains. One new gate replaced old one; 15 gates repaired; 24 new gate boxes set in connection with new mains; 21 to replace old ones; two new car sprinkling hydrants; two new cart sprinkling hydrants; 18 street sprinkling hydrants repaired; three new fire hydrants replaced old ones; one new hydrant was put in; 20 fire hydrants were repaired.

Two hundred and thirteen feet of ledge excavated in the service trenches; 222 new services were put in; 26 were extended; 21 discontinued; 68 renewed; six changed for Sewer Department; 121 service boxes were put in; two lowered; 386 lead connections were renewed with corporation cocks; 38 lead connections were renewed without corporation cocks; 252 service leaks were repaired; 1,195 service pipes were bushed out; seven private hydrants were repaired; 327 new meters were put in; 213 changed for old ones; 239 meters were repaired; 48 were exchanged for other meters; nine removed and tested; 28 new meter boxes replaced old ones; two new meter boxes for new meters; 82 leaks repaired in main pipes; 2,319 feet of 10-inch pipe was laid to provide an additional water supply for the General Electric Company.

Respectfully submitted,

D. A. SUTHERLAND,

Superintendent.

Microscopical Examination of Water from Birch Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1902.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	September 11.	October 9.	November 14.	December 12.
Number of Sample . .	38589	38985	39266	39630	39994	40491	41092	41579	42198	42644	43161	43461
Plants.												
DIATOMACEÆ:	11	21	20	176	1868	309	105	764	218	211	209	49
Asterionella	2	0	0	22	420	1	0	0	48	37	23	6
Melosira	0	0	0	40	138	33	0	30	22	115	52	0
Synedra	1	13	18	48	12	1	0	2	0	28	110	43
Tabellaria	8	6	1	66	1206	274	104	732	142	31	20	0
CYANOPHYCEÆ:	0	0	0	0	0	0	1	40	20	127	1	0
Anabæna	0	0	0	0	0	0	0	0	0	112	0	0
Clathrocystis	0	0	0	0	0	0	1	40	6	11	0	0
ALGÆ:	0	4	0	6	28	0	26	62	8	8	0	4
Animals.												
INFUSORIA:	44	1	49	482	120	89	59	4	8	40	12	15
Chlamydomonas . .	0	0	0	0	0	0	0	0	0	0	0	14
Dinobryon	26	0	33	460	110	0	45	0	0	0	0	0
Glenodinium	0	0	2	2	0	0	0	0	0	13	11	0
Monas	0	0	1	0	0	86	2	0	0	5	0	0
Peridinium	16	0	9	0	0	0	0	0	0	0	0	0
Trachelomonas . . .	0	0	0	4	0	1	1	2	4	12	1	0
Uroglena	1	0	0	14	8	0	11	0	0	0	0	0
VERMES:	2	1	0	6	2	0	4	2	2	4	3	0
CRUSTACEA:												
Cyclops	0	0	pr.	0	0	0	0	.02	0	0	.02	0
Daphnia	0	0	0	0	0	.02	0	0	0	0	0	0
Entomostracan ova .	0	0	0	0	0	0	1	0	0	0	0	0
MISCELLANEOUS:												
Zooglaea	5	5	7	8	5	8	5	5	5	5	5	5
Mites	0	.02	0	.02	0	0	0	.02	.04	0	0	.04
Zoospores	0	0	0	0	0	0	0	0	0	3	0	0
Total	62	32	76	678	2023	406	201	877	261	398	230	73

Microscopical Examination of Water from Breeds Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1902.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	September 12.	October 9.	November 14.	December 12.
Number of Sample . .	38590	38986	39267	39631	39995	40492	41093	41580	42199	42645	43160	43462
Plants.												
DIATOMACEÆ:	8	0	2	27	236	932	240	174	252	459	62	60
Asterionella	8	0	0	13	12	138	1	89	198	412	9	0
Tabellaria	0	0	0	0	206	792	230	84	54	41	38	40
CYANOPHYCEÆ:	0	0	0	0	0	37	10	52	0	3	2	0
Anabæna	0	0	0	0	0	37	6	52	0	3	2	0
ALGÆ:	0	0	0	0	3	10	24	19	4	10	1	0
Animals.												
INFUSORIA:	14	19	257	133	37	7	8	14	36	7	1	13
Ciliated infusorian .	12	0	0	0	0	0	0	0	0	0	0	0
Dinobryon	0	3	254	128	31	2	2	3	9	1	1	5
Peridinium	1	10	1	3	0	1	3	0	12	0	0	2
Uroglena	0	0	0	0	0	0	0	3	0	0	0	0
VERMES:	1	0	1	1	0	0	5	1	0	1	2	0
CRUSTACEA: Cyclops .	pr.	0	pr.	0	0	0	pr.	0	0	0	0	0
MISCELLANEOUS:												
Zoogloea	3	5	5	5	5	5	5	5	5	3	3	5
Total	26	24	265	166	281	991	292	265	297	483	71	78

Microscopical Examination of Water from Glen Lewis Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1902.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	September 12.	October 9.		
Number of Sample . .	38988	39268	39632	39996	40493	41094	41581	42200	42646		
Plants.											
DIATOMACEÆ:	0	0	650	2004	630	316	309	116	761		
Asterionella	0	0	84	58	2	204	0	5	16		
Cyclotella	0	0	0	0	82	0	0	0	0		
Melosira	0	0	448	812	522	18	41	41	736		
Synedra	0	0	6	452	4	4	0	1	1		
Tabellaria	0	0	110	680	20	90	268	69	18		
CYANOPHYCÆ:	1	0	2	6	36	70	89	18	3		
Anabaena	0	0	0	0	0	4	82	13	0		
Clathrocystis	0	0	0	0	84	66	5	2	3		
ALGÆ:	0	4	0	34	20	4	33	2	190		
Protococcus	0	4	0	32	0	0	26	0	157		
Animals.											
INFUSORIA:	59	127	40	18	14	76	4	52	14		
Dinobryon	0	86	8	10	0	0	1	0	0		
Euglena	11	0	6	4	8	8	1	1	1		
Euglena acus	21	1	0	0	0	0	0	0	0		
Glenodinium	0	40	12	0	0	0	0	40	0		
Peridinium	27	0	4	0	0	0	1	5	1		
Trachelomonas	0	0	0	2	6	66	0	6	9		
Uroglena	0	0	10	2	0	2	1	0	0		
VERMES:	1	2	8	2	0	2	0	1	1		
CRUSTACEA: Cyclops .	0	pr.	0	0	0	0	0	0	.02		
Entomostracan ova	0	0	0	0	0	0	1	0	0		
MISCELLANEOUS:											
Zooglaea	5	5	5	10	10	10	7	5	5		
Mites	0	0	0	0	0	.04	.02	0	.02		
Total	66	138	705	2074	760	478	443	194	984		

Microscopical Examination of Water from Hawkes Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1902.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	September 12.	October 9.	November 14.	December 12.
Number of Sample . .	38591	38987	39269	39633	39997	40494	41095	41582	42201	42647	43162	43463
Plants.												
DIATOMACEÆ:	41	2	1	61	108	198	119	73	45	17	31	79
Asterionella	18	0	0	35	17	33	69	10	9	3	8	18
Cyclotella	23	2	0	2	2	46	12	52	2	2	19	60
Tabellaria	0	0	0	13	68	98	36	10	10	6	14	0
CYANOPHYCEÆ:	0	0	0	0	0	1	11	0	7	1	0	0
Anabæna	0	0	0	0	0	1	11	0	6	1	0	0
ALGÆ:	0	0	0	0	9	32	3	23	5	2	0	1
Animals.												
INFUSORIA:	4	9	96	7	1	113	5	44	15	11	10	0
Dinobryon	0	0	94	3	1	105	3	40	3	0	0	0
Synura	0	0	0	0	0	0	0	0	1	0	0	0
Uroglena	0	0	0	0	0	0	0	0	0	0	10	0
VERMES:	0	3	1	2	0	0	0	0	0	0	0	0
CRUSTACEA: Cyclops.	pr.	0	0	0	0	0	0	0	0	0	pr.	0
MISCELLANEOUS,												
Zoogloea	5	5	5	3	3	5	5	3	5	5	3	3
Mites	0	0	0	0	0	0	0	0	.02	.02	0	0
Zoospores	0	0	0	0	0	0	224	0	0	0	0	0
Total	50	19	103	73	121	349	367	143	77	36	54	83

Microscopical Examination of Water from Walden Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1902.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.			
Number of Sample	38592	38989	39270	39634	39998	40495	41996			
Plants.										
DIATOMACEÆ:	64	8	15	438	744	696	838			
Asterionella	8	0	5	224	166	52	253			
Melosira	0	0	0	190	484	596	494			
Synedra	56	8	10	24	86	44	0			
Tabellaria	0	0	0	0	0	4	86			
CYANOPHYCEÆ:	0	0	1	0	0	2	0			
ALGÆ:	0	4	0	6	10	2	154			
Arthrodesmus	0	0	0	0	0	0	118			
Animals.										
INFUSORIA:	155	56	924	134	14	2	248			
Chlamydomonas	92	0	0	0	0	0	0			
Dinobryon	8	20	814	120	4	0	172			
Euglena	4	0	11	2	0	0	2			
Mallomonas	2	0	35	2	0	0	8			
Peridinium	43	27	59	0	2	0	0			
Synura	1	6	3	2	0	0	0			
Trachelomonas	0	2	0	2	0	2	66			
Uroglena	0	0	1	4	8	0	0			
VERMES:	8	14	4	4	2	0	4			
CRUSTACEA:										
Cyclops	0	0	0	0	0	0	.02			
MISCELLANEOUS:										
Zoogloea	5	5	5	7	5	5	7			
Mites	0	0	0	0	0	.02	.04			
Total	232	87	949	589	775	707	1251			

Microscopical Examination of Water from Saugus River at Montrose.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1902.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	September 12.	October 9.	December 12.
Number of Sample . .	38593	38990	39272	36635	40000	40496	41097	41583	42202	42648	43464
Plants.											
DIATOMACEÆ:	26	4	11	22	10	27	11	4	18	0	12
CYANOPHYCÆ:	1	0	0	0	1	0	0	2	2	0	0
ALGÆ:	0	0	3	1	1	2	1	8	0	0	1
Animals.											
INFUSORIA:	19	5	22	13	0	20	1	0	1	0	4
Dinobryon	6	0	16	12	0	20	0	0	0	0	0
Peridinium	10	5	1	0	0	0	0	0	0	0	0
Synura	2	0	2	0	0	0	0	0	0	0	0
VERMES:	2	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS, Zooglaea	5	3	3	3	3	5	5	5	5	3	5
Total	53	12	39	39	15	54	18	19	26	6	22

Microscopical Examination of Water from a Faucet in Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	October 9.	November 14.	December 12.
Number of Sample . .	38594	38991	39271	39636	39999	40497	41098	41584	42649	43163	43465
Plants.											
DIATOMACEÆ:	9	6	4	39	259	120	378	159	160	17	1
Melosira	0	0	0	0	63	0	11	3	107	0	0
Tabellaria	0	4	0	13	146	120	344	150	32	4	0
CYANOPHYCÆ:	0	0	0	0	0	0	4	1	3	1	0
ALGÆ:	0	0	0	2	8	2	12	1	11	2	0
Animals.											
INFUSORIA:	4	1	6	25	11	1	63	1	2	0	1
Dinobryon	0	0	5	24	7	0	63	0	1	0	0
VERMES:	0	0	0	0	2	0	2	0	0	0	0
MISCELLANEOUS,											
Zoogicea	3	3	3	5	5	3	5	10	5	3	3
Sponge spicules . .	0	0	0	0	0	0	0	1	0	0	0
Total	16	10	13	71	285	126	464	173	181	23	5

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1902.

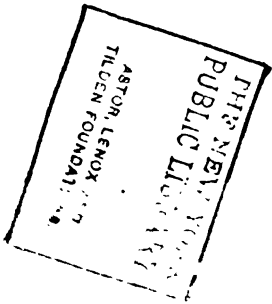
MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	141,209,380	4,555,141	45,398	. . . . .	60.75	61.56
February	122,874,690	4,388,381	. . . . .	13,275	58.52	59.30
March	131,928,164	4,255,747	. . . . .	4,783	56.74	57.51
April	128,948,344	4,298,278	7,394	. . . . .	57.31	58.08
May	140,764,226	4,540,781	387,562	. . . . .	60.54	61.36
June	148,631,252	4,954,375	334,693	. . . . .	66.06	66.95
July	154,475,916	4,980,994	174,941	. . . . .	66.44	67.34
August	156,602,238	5,051,685	489,149	. . . . .	67.35	68.27
September	148,548,614	4,951,620	362,571	. . . . .	66.02	66.91
October	143,573,518	4,631,404	. . . . .	236,453	61.75	62.59
November	136,998,872	4,566,629	54,605	. . . . .	60.89	61.71
December	155,299,786	5,009,670	668,463	. . . . .	66.79	67.70
Totals and averages	1,709,855,000	4,684,534	178,581	. . . . .	62.42	63.30

Basis: Population, Lynn and Saugus, 75,000,

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1902.

MONTH.	GALLONS.					
	Breed's.	Birch.	Walden.	Lewis.	Hawkes.	Total.
January			18,791,500		120,834,000	139,625,500
February	23,032,450				101,207,050	124,239,500
March	65,506,875		47,199,250		18,307,635	131,013,750
April	33,479,250		94,251,500			127,730,750
May	59,378,812		83,431,688			142,810,500
June			148,531,250			148,531,250
July			154,509,250			154,509,250
August	15,501,355	106,827,145	32,144,000			154,472,500
September	32,566,625	116,332,125				148,898,750
October		24,242,750		122,524,500		146,767,250
November	46,380,542	80,529,458		5,867,750		132,777,750
December	82,149,520	29,991,063			46,337,667	158,478,250
Totals	357,995,429	357,922,541	578,858,438	128,392,250	286,686,342	1,709,855,000



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TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1902.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	0.68	..	..	0.03	..	0.16	..	0.08	0.25	..	..
2	*0.06	0.55	0.12	..	0.06	..	..	0.04	..	..	..	0.40
3	..	..	..	..	..	0.03	0.48	..	0.58	..	..	0.09
4	..	*0.04	..	..	0.15	..	..	..	0.10	..	..	*0.15
5	..	..	*1.07	..	..	..	..	..	..	1.03	..	*0.52
6	..	..	..	..	0.10	..	..	0.48	..	..	..	..
7	*0.63	..	..	..	..	0.05	..	..	0.40	..	..	*0.12
8	..	*0.03	0.13	1.92	..	..	..	0.27	..	..	..	..
9	..	..	0.64	0.92	..	..	0.03	..	0.29	..	..	..
10	*0.03	..	..	..	..	..	0.20	0.20	..	..	..	*0.05
11	*0.60	..	0.03	0.06	..	..	..	1.12	..	0.06	0.07	*0.12
12	..	*0.03	..	..	0.02	0.15	..	..	..	0.06	0.02	*0.08
13	..	*0.04	0.02	..	..	0.05	..	..	0.20	..	0.07	*0.60
14	..	..	..	..	..	0.10	..	..	..	..	..	..
15	..	..	..	..	..	0.08	0.40	..	..	..	..	*0.15
16	..	..	0.61	..	..	0.03	..	..	..	..	0.01	0.85
17	..	*1.46	0.09	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	0.05	..	..	..	..
19	..	..	0.14	..	0.40	0.32	0.53	0.13	..	..	..	..
20	..	..	0.24	..	..	..	1.12	..	0.04	..	..	..
21	0.33	*0.35	..	..	..	0.98	0.01	0.01	..	..	..	1.44
22	0.09	..	..	..	..	..	0.04	0.44	..	0.32	..	..
23	..	..	..	..	..	..	..	0.02	..	0.07	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	1.25	..	0.12	0.05	0.30	0.05	..	..	..	0.08	*0.85
26	0.15	.76	..	0.32	..	0.10	..	..	0.01	..	0.88	0.02
27	..	..	0.07	..	0.16	..	..	..	0.35	1.37	0.09	..
28	..	1.76	0.45	..	..	..	..	..	0.05	0.05	..	..
29	..	..	0.80	0.62	..	0.08	..	..	0.04	..	..	0.15
30	*0.02	..	..	0.57	..	..	..	..	0.24	..	*0.25	..
31	*0.04	..	..	..	..	..	..	..	..	..	..	..
Total	2.00	6.05	4.41	4.23	0.97	2.27	3.02	2.71	3.03	4.81	1.47	5.59

* Snow.

Total for the year 41.46.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1902.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	..	.55	..	..	..	..	.13	..	.07	.19	..	..
2	..	.39	.04	..	..	..	..	.09	..	..	..	.36
310	.06	.46	..	.38	..	..	..
4	..	*.02	..	..	..	..	..	..	.10	..	..	*.14
5	*.87	..	..	..	..	..	..	1.00	..	*.02
618	..	..	.32	..	..	..	..
7	*.37	..	..	..	..	.03	..	..	.38	..	..	*.14
810	2.12	..	..	..	.27	..	..	..	..
945	.43	..	..	..	.18	.24	..	..	..
1022	..	..	..	..	..
11	*.67	..	..	.07	..	..	..	.65	..	1.07	.05	*.10
12	..	*.01	..	..	..	.16	..	..	..	.03	.07	*.10
1302	..	..	.01	..	..	..	..	..	*.10
14
1518	.50	..	..	..	..	5.818
1653	..	..	.05	..	..	..	..	..	.59
17	..	*.89	.07	..	..	..	..	..	..	..	..	..
18
1912	..	.36	.28	.47	.13	..	..	..	..
2014	..	..	..	.93	..	.03	..	..	..
21	.25	*.26	..	..	..	.73	..	.03	..	..	..	1.30
22	.03	..	..	..	..	..	.08	.41	..	.30	..	..
23
2401	..	..	..	..	..	..	..
25	..	1.15	..	.14	.05	.30	..	..	..	..	.20	*.53
26	..	.75	..	.27	..	.03	..	..	..	..	.75	.05
2704	..	.14	..	..	..	.33	1.33	.00	..
28	..	1.48	.42	..	..	..	..	..	.60	.63	..	..
2962	.57	..	.08	..	..	.02	..	..	.03
3049	..	..	..	..	.27	..	.23	..
31
Total	1.32	5.50	3.42	4.09	.84	1.91	2.79	2.08	2.35	4.55	1.39	3.54

* Snow.

Total for the year, 33.78.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1902.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Glen Lewis Pond.
January 5	25.1	16.8	8.1	12.4	13.4
January 12	25.5	17.2	8.5	13.2	13.6
January 19	24.3	17.4	8.	13.5	13.10
January 26	24.3	17.8	8.1	13.9	14.4
February 1	24.3	17.10	8.2	14.	14.5
February 8	24.1	19.1	8.1	14.4	15.3
February 15	24.	19.3	7.9	14.5	15.6
February 22	22.4	19.1	8.6	14.8	15.9
March 1	25.4	20.11	10.5	16.3	18.3
March 8	25.10	20.6	11.11	17.2	19.3
March 15	26.1	20.6	16.3	16.11	19.
March 22	26.	20.6	17.	17.2	19.
March 29	26.	20.3	17.10	17.1	19.
April 5	26.	20.3	19.8	16.10	19.1
April 12	26.	20.5	20.9	17.4	19.2
April 19	25.8	20.3	20.3	17.3	18.10
April 26	25.6	20.	20.1	17.2	18.10
May 3	26.	20.5	19.3	16.11	18.10
May 10	26.	20.3	20.6	16.	18.5
May 17	25.7	19.6	20.2	15.10	18.
May 24	25.1	18.6	18.10	15.10	18.3
May 31	25	18.6	18.3	15.9	18.
June 6	24.6	18.5	17.5	15.3	18.2
June 13	23.11	18.4	18.8	13.	18.
June 20	23.8	18.3	19.7	11.10	17.10
June 27	23.6	18.4	19.8	10.1	17.10
July 4	23.2	18.4	19.7	9.8	17.9
July 11	22.10	18.3	19.1	8.06	17.8
July 18	22.6	18.3	18.7	7.10	18.
July 25	22.4	18.3	18.4	7.	17.11
August 1	22.1	18.3	18.3	5.5	18.
August 8	21.10	18.4	17.7	.	18.
August 15	21.7	18.3	16.3	.	18.
August 22	21.6	18.2	15.5	.	18.
August 29	21.3	17.2	14.5	.	18.
September 5	21.1	16.6	13.5	.	18.
September 12	20.11	16.	12.9	.	18.
September 19	20.8	15.6	11.4	.	17.10
September 26	20.6	15.7	10.3	.	16.10
October 3	20.8	15.8	9.7	.	16.4
October 10	20.8	15.8	9.2	.	14.2
October 17	20.18	15.9	9.5	.	13.
October 24	20.5	1.59	9.6	.	8.9
October 31	20.8	15.11	9.10	.	6.
November 7	20.9	15.10	9.8	.	4.
November 14	20.8	15.4	8.3	.	.
November 21	20.8	14.11	7.8	.	.
November 28	20.11	14.6	6.	.	.
December 5	20.1	14.	6.	.	.
December 12	21.2	13.9	6.	.	.
December 19	20.5	12.7	6.3	4.7	.
December 26	22.9	13.1	8.9	6.6	6.4

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1901.

STREET.	LOCATION.
Burchstead Place	On west line of Union street, 12 feet north from south line of Burchstead place.
Chatham.....	On east line of Western avenue, 17 feet south from north line of Chatham street.
Chatham.....	On east line of Clarendon avenue, 17 feet south from north line of Chatham street.
Coburn	On north line of Sewall street, 17 feet east from west line of Coburn street.
Eastern avenue..	On west line of Williams avenue, 16 feet, 8 inches north from south line of Eastern avenue.
Eastern avenue..	On east line of Essex street, 20 feet south from north line of Eastern avenue.
Fuller.....	On north line of Woodman street, 15 feet west from east line of Fuller street.
Light	On east line of Summer street, 12 feet, 4 inches north from south line of Light street.
Nahant	On east line of Sagamore street, 47 feet north from south line of Nahant street.
Nichols	On south line of Cherry street, 15 feet, 6 inches east from west line of Nichols street.
Ray	On east line of Pitkin street, 14 feet, 8 inches south from north line of Ray street.
Western avenue .	At a point opposite Light street, 19 feet, 8 inches east from west line of Western avenue, and 3 feet north from division line of 871-875.

TABLE VII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE.

KIND.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{2}$ in.	2 in.	3 in.	4 in.	Total
Trident	807	810	85	4	5	...	...	1,711
Thomson	173	363	90	16	3	1	1	647
Lambert	186	160	14	4	12	...	...	376
Hersey	84	62	2	1	...	...	...	149
Ball and Fitts	34	32	17	...	...	...	...	83
Union	4	22	7	7	9	...	12	61
Nash	54	13	1	...	...	...	...	68
Niagara	34	30	1	...	...	...	...	65
Columbia	46	5	...	...	...	...	...	51
Crown	1	5	3	2	...	...	...	11
Empire	12	11	...	2	2	...	1	28
All others	3	7	4	3	4	2	...	23
Motors	3	...	...	...	...	...	...	...
Totals	1,438	1,520	224	39	35	3	14	3,273

TABLE VIII.

SHOWING CONSUMPTION IN GALLONS OF ESTIMATED AND METERED
QUANTITIES.

Domestic, non-metered	978,255,559
Manufacturing, metered	270,000,000
Domestic, metered	190,000,000
Loss in registration, 5 per cent. estimated .	1,950,000
Loss in distribution, 10 per cent. estimated pumpage	164,467,284

CITY PURPOSES.

Street sprinkling	42,000,000
Watering troughs	32,000,000
Schools	13,000,000
Fires	5,000,000
Sewers	3,000,000
Highway Department	3,000,000
Engine houses	2,000,000
Fountains	2,000,000
City Hall	1,000,000
Police Station	1,000,000
Health Department	1,000,000
Cemeteries	500,000
Public Library	500,000
Water Department	500,000
All others	500,000
	<hr/>
	110,000,000
Total	<hr/>
	1,709,855,000

TABLE IX.

SHOWING TOTAL LENGTH AND LIZES OF SERVICES LAID IN LYNN
AND SAUGUS.

	4 in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	Total.
Lynn	141	881	139	5,331	2,718	86	9,296
Saugus . . . . .	...	162	...	518	1,003	...	1,690
Total	141	1,050	139	5,849	3,721	86	10,986

TABLE X.

SHOWING THE SIZE AND TOTAL LENGTH OF IRON PIPE LAID IN 1902.

WHERE LAID.	10 in.	8 in.	6 in.	4 in.	Total.
Bassett*	964	964
Burchstead place*	436	436
Crosby*	499	499
Cherry*	1,087	...	1,087
Chatham*	2,128	...	2,128
Coburn†	255	255
Eastern avenue†	228	...	228
Fayette†	84	...	84
Fuller†	254	254
Fayette court†	285	285
High Rock street*	437	...	437
Nahant*	1,200	...	...	1,200
Nichols*	470	...	470
Rock avenue†	300	...	300
Sagamore*	780	780
Shepard *	1,839	...	1,839
Washington *	2,595	...	2,595
Light, Ray, Pitkin*†	2,319	...	...	...	2,319
	2,319	1,200	9,168	3,473	16,160

	MILES.	FEET.
*Total length relaid.	2	3,479
†Total length extended.		2,121
Total length new streets		
Total length system	134	4,610
Total in Swampscott		1,788
Total in Saugus	18	3,652

SUMMARY OF STATISTICS.

FOR THE YEAR ENDING DECEMBER 31, 1902.

In form recommended by the New England Water Works Association.

LYNN WATER WORKS, LYNN, ESSEX CO., MASS.

GENERAL STATISTICS.

Population by census of 1900,	68,513
Date of construction,	1871
Owned by	City of Lynn
Source of supply,	Artificial ponds and river
Mode of supply,	Pumping to reservoir

PUMPING STATISTICS.

1. Builders of Pumping Machinery, Leavitt, and A. J. L. Loretz
2. Description of fuel used,
 - a. Kind, soft.
 - b. Brand of coal used, Georges Creek.
 - c. Average price of coal per gross ton, delivered, \$5.00.
 - d. Percentage of ash, 9.8.
 - e. Wood, price per cord.
3. Coal consumed for the year, in pounds, 2,686,600

4. [Pounds of wood consumed] $\div 3 =$
equivalent amount of coal, pounds,
- 4a. Amount of other fuel used,
5. Total equivalent coal consumed for
the year $= (3) + (4)$, in pounds, 2,686,600
6. Total pumpage for the year, in gal-
lons, { ^{with} } allowance for slip, 1,709,855,000
7. Average static head against which
pumps work, in feet, 147.26
8. Average dynamic head against which
pumps work, in feet, 149.13
9. Number of gallons pumped per pound
of equivalent coal (5), 636.4
10. Duty $= \frac{\text{gallons pumped (6)} \times 8.34 \text{ (lbs.)} \times 100 \times \text{dynamic head (8)}}{\text{Total fuel consumed (5)}}$ 87,757.210

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$11,130.62.

11. Per million gallons pumped, \$6.43
12. Per million gallons raised one foot
(dynamic), \$0 04 $\frac{1}{3}$

FINANCIAL STATISTICS.

RECEIPTS.		EXPENDITURES.	
(a) From ordinary (main-tenance) receipts,		<i>Water Works Maintenance:</i>	
(b) From extraordinary receipts (bonds, etc.),		A.A. Operation (management and repairs),	
Total,		CC. Total maintenance,	
		DD. Interest on bonds,	
		FF. Sinking Fund,	
<i>From Water Rates:</i>		<i>Water Works Construction:</i>	
A. Fixture rates,		GG. Extension of mains,	
B. Meter rates,		HH. Extension of services,	
		JJ. Increased storage,	
C. Total from consumers,		KK. Total construction	
L. From bond issue,		Total balance,	
M. From other sources,		N. Total,	
N. Total,			

DISPOSITION OF BALANCE, TO CONSTRUCTION, 1903.

O. Net cost of works to date,	\$2,677,710.83
P. Bonded debt at date,	2,175,300.00
Q. Value of Sinking Fund at date,	642,797.44
R. Average rate of interest, 4 per cent.	

STATISTICS OF CONSUMPTION OF WATER.

1. Estimated population at date,	75,000
2. Estimated population on lines of pipe,	74,000
3. Estimated population supplied,	74,000
4. Total consumption for the year (gallons),	1,709,855,000
5. Passed through meters (gallons),	460,000,000
6. Percentage of consumption metered,	25 per cent.
7. Average daily consumption in gallons,	4,684,534
8. Gallons per day to each inhabitant,	62.42
9. Gallons per day to each consumer,	63.30
10. Gallons per day to each tap,	360
11. Cost of supplying water, per million gallons, figured on total maintenance (item CC),	\$43.27
12. Total cost of supplying water, per million gal- lons, figured on total maintenance + inter- est on bonds,	\$90.00

STATISTICS RELATING TO DISTRIBUTION
SYSTEM.

MAINS.

1. Kind of pipe,	Cement-lined, and cast-iron.
2. Sizes,	From 36 to 4 inch.
3. Extended during year (feet),	3,940

4. Discontinued during year (feet),	None.
5. Total now in use (miles),	132½
6. Cost of repairs per mile,	\$136.00
7. Number of leaks per mile,	1.61
8. Length of pipes less than 4 inches diameter (miles),	
9. Number of hydrants added during year (public and private),	1
10. Number of hydrants (public and private), now in use,	963
11. Number of stop gates added during year,	15
12. Number of stop gates now in use,	992
13. Number of stop gates smaller than 4-inch,	
14. Number of blow-offs,	65
15. Range of pressure on mains (pounds),	40 to 60

SERVICES.

16. Kind of pipe,	Cement-lined and lead-lined
17. Sizes (inches),	½ to 4
18. Extended (feet),	10,986
19. Discontinued (feet),	316
20. Total now in use (miles),	99½
21. Number of service taps added during year,	222
22. Number now in use,	12,873
23. Average length of service (feet),	40
24. Average cost of service for the year,	\$18.00
25. Number of meters added,	327

PUBLIC WATER BOARD REPORT.

45

- 26. Number now in use, 3,273
- 27. Percentage of services metered, 25 per cent.
- 28. Percentage of receipts from metered water (B + C), 23 per cent.
- 29. Number of motors and elevators added,
- 30. Number now in use, ° 7

55 1912
522

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ANNUAL REPORT

OF THE

PUBLIC WATER BOARD

OF THE

CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1903.



LYNN, MASS.
WHITTEN & CASS, PRINTERS
1904

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ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1903.

Compliments of

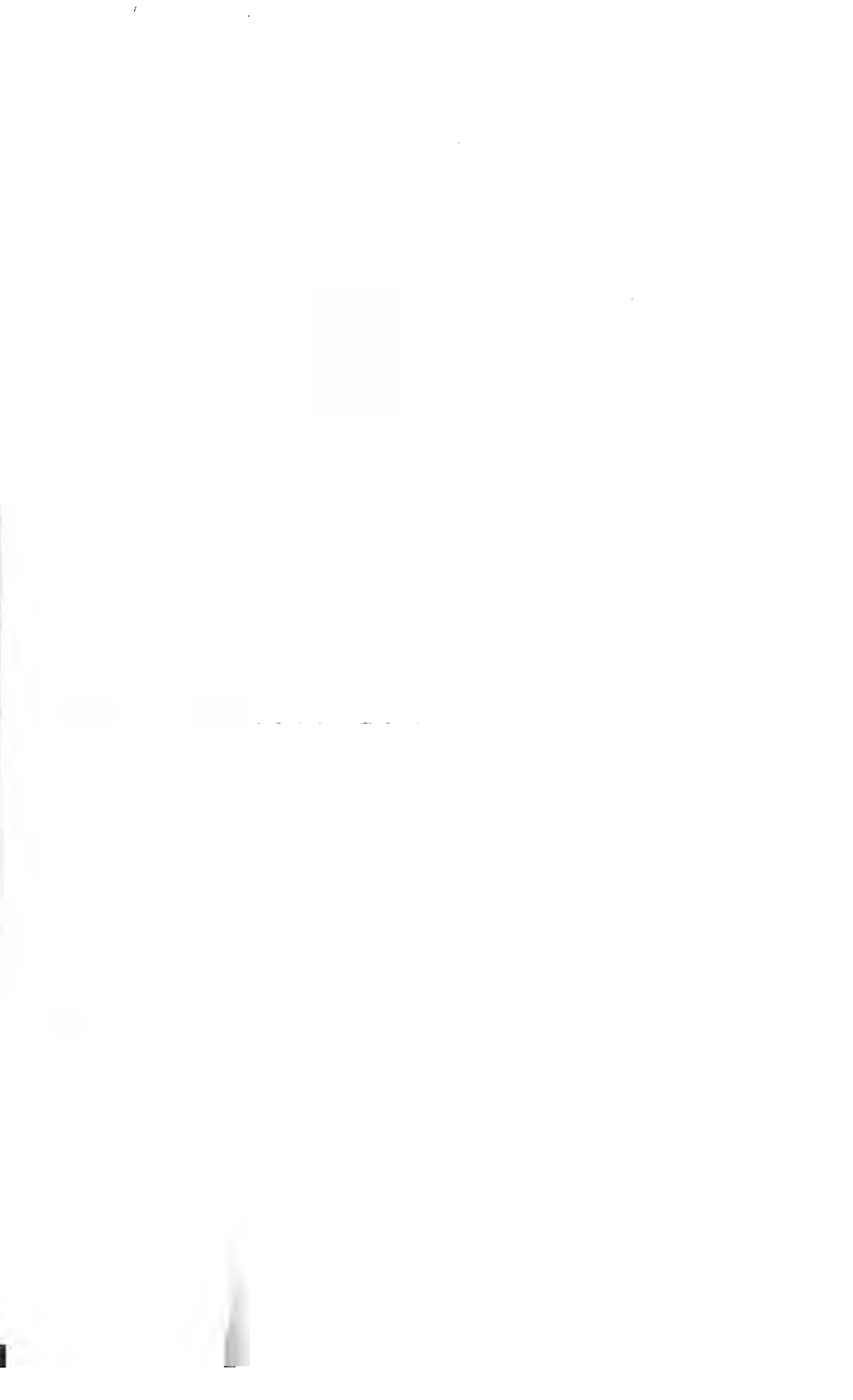
 *Public Water Board,*

WM. B. LITTLEFIELD, *Prest.*

LYNN, MASS.
WHITTEN & CASS, PRINTERS

1904

R. L. M.



ANNUAL REPORT
OF THE
PUBLIC WATER BOARD
OF THE
CITY OF LYNN

FOR THE YEAR ENDING DECEMBER 31, 1903.



LYNN, MASS.
WHITTEN & CASS, PRINTERS

1904

R. L. M.

PUBLIC WATER BOARD FOR 1904.

W. B. LITTLEFIELD, *Pres.*, for one year.

S. W. DEARBORN, for two years.

JAMES BURNS, for three years.

C. E. SPRAGUE, for four years.

THOMAS P. NICHOLS, for five years.

OFFICERS FOR 1903.

THOMAS P. NICHOLS,
For one year.

WILLIAM B. LITTLEFIELD, *Pres.*
For two years.

S. W. DEARBORN,
For three years.

JAMES BURNS,
For four years.

C. E. SPRAGUE,
For five years.

Superintendent and Clerk, D. A. SUTHERLAND.

Water Registrar, WALLACE O. MUDGE.

Pumping Engineer, C. A. COWLES.

Assistant Engineer, GEORGE H. VENN.

Foreman of Mains, EDWIN MAXWELL.

Foreman of Services, HENRY WHELOCK.

Foreman of Meters and Repairs, W. H. McLAIN.

INSPECTORS.

WINSLOW J. ROWELL,
J. FRANK POOL,

W. B. MOULTON,
JOHN CHAMBERLAIN.

CLERKS.

MABEL R. BUTLER,

M. E. RANKINS.

ANNUAL REPORT.

To the Honorable Mayor and City Council:

GENTLEMEN,—The Public Water Board, in conformity with the charter and ordinances, have the honor to present this thirty-second annual report, together with the reports of the Superintendent and Registrar.

Our Sources of Supply.

Our present system comprises :

Ponds.	Acres.	Capacity in Gallons.
Breed's	54.85	262,563,340
Birch	82	381,062,901
Glen Lewis	36	120,475,126
Hawkes	75	300,000,000
Walden	128	403,163,626
A total storage of		1,467,265,193

In connection with these sources we have a conduit from Saugus River to Hawkes Pond, having a daily capacity for delivering about 30,000,000 gallons. The water-shed, from which the city has a right to take water which contributes to this supply, contains less than fifty inhabitants to the square mile, and is absolutely free from all direct sewage contamination.

Our total consumption this year was 1,875,197,646 gallons, an increase of 165,342,646 gallons over the preceding year. The consumption of water the past year has been 407,932,453 gallons in excess of our storage capacity.

On December 15, 1902, the several ponds contained 287,935,112 gallons. On the above date the ponds had reached the lowest depth for the year. The lowest point reached in 1903 was on

December 29th, when the several ponds contained 179,180,262 gallons, showing a decrease from 1902 of 108,754,850 gallons.

If the rainfall the past year had been as light as in 1899, which was 33.90 inches, against 42.68 inches the present year, the ponds would have been dry, and we should have been obliged to depend entirely on Saugus River for a supply.

The above figures show the work now in progress was not commenced any too soon for the safety of our water supply.

New Pumps.

The new pumps, built by A. J. Loretz & Son, located at Walden Pond, with a thirty million daily capacity, were started March 17, for the purpose of filling Walden Pond. It required running the pumps twenty-five days, giving them a good trial, which proved entirely satisfactory.

If the capacity of the canal had been sufficient to supply the pumps the filling of the pond would have been accomplished in several days less time.

The canal from the Pumping Station to the tunnel at Birch Pond has been discontinued and in place two 30-inch pipes have been laid.

The grounds around the Pumping Station have been graded and grassed over, and ornamental vines have been set at intervals of twenty-five feet around the building, giving the appearance of progression along the line of improvement.

New Roads.

The new road from Walden Pond Road to Penny Brook Road has been completed, also the road from Penny Brook to the Great Woods Road. The lines of this road, as laid out by the Board, were through rough portions of the park, consisting of steep hills, deep valleys and ledges. Several hundred feet of ledge were blasted and hills were cut down to fill the valleys. Pleasure-seekers will appreciate the labor of the Board, as the environments of the road cannot be excelled by any place in Essex county for natural scenery and beauty. The new road was completed on November 7, 1903.

Covering Vegetable Matter in the Bottom of Ponds.

Water was drawn from Walden and Glen Lewis Ponds for the purpose of continuing the work of removing the stumps, and to gravel the bottom of the ponds. Work was commenced November 16, 1903, and continued until December 19, 1903. It was carried on under many difficulties, owing to the exceedingly cold weather. Notwithstanding the obstructions of frozen earth and cold weather the work was carried forward with favorable results.

About fifteen acres were covered with gravel and the stumps removed and burned. The number of acres covered, added to that previously done, amounts to about 125 acres.

A portion of the bottom of the pond has been covered for ten years, and we find it in as good condition as when first completed. This work has been adopted by the Metropolitan and other water-works.

Grubbing.

The work of grubbing along the shores of the ponds has been carried along with the work on the roads. The soil taken off has been used on the roads, making a place to deposit the soil, and has proved to be good material for road building, besides saving much expense. Previously we were obliged to haul the soil a long distance, in order to deposit it outside the water-line.

Walden Pond Dam.

The work on Walden Pond dam is being carried forward as rapidly as possible. A large amount of work has been accomplished the past year on the core wall and embankment.

On account of the cold weather, work on the the core-wall has been discontinued, but the work of filling the embankment will be continued through the winter.

Five hundred and ten feet of the core-wall has been completed, and the remaining portion has been carried to very near the height of the old dam.

The contractor, Mr. Frederick E. Shaw, will finish the work in 1904. It will be necessary to have the work completed the coming year as the city is very much in need of an increased storage.

The following figures will give an estimate of the work done on this pond to date :

Stripping 15,000 cubic yards. @ \$.40 . . .	\$6,080 00	
Trench excavation 14,300 cubic yards @ \$.60 . . .	11,440 00	
Rock excavation 576 cubic yards @ \$3.50 . . .	2,016 00	
Enbankments 47,000 cubic yards @ \$ 40 . . .	18,800 00	
Concrete "A" 2,458 cubic yards @ \$5.65 . . .	14,379 30	
Concrete "B" 14,166 cubic yards @ \$5.50 . . .	77,913 00	
Concrete "C" 282 cubic yards @ \$6.50 . . .	1,833 00	
Plastering 6,500 square yards @ \$ 35 . . .	2,275 00	
Sheet piling in place of excavation and concrete, including pumping, and all incidental expenses, 108.073 M-B-M. @ \$235 per M.	23,398 33	
Spruce lumber 17,240 M-B-M. @ \$20 per M.	344 80	
		\$160,479 43
Less 10 per cent.		16,047 94
		\$144,431 49
Less sixteen previous payments		142,631 49
		\$1,800 00

Electrolysis.

Electrolysis is causing serious trouble with our main and service pipes. The Board in their yearly report of 1901 called the attention of the City Council to the destruction of main and service pipes caused by electrolysis. The members of the Board desire that some action may be taken to eliminate the cause of destruction of our pipes.

We have in the past removed pipes in the following streets which were destroyed by electrolysis: A leak in 10-inch main, State street, a service pipe Newhall building, Central square, numbers 800, 934, 864, 852 and 768 Washington street, number 416 Union street, Camden street, Jones shoe factory on Broad street, Broad corner Washington street, 102 Blossom street, 112 High Rock street, 325 Broad street, 154 Market street, 6 Kirtland street, 934 Washington street, Fuller block, Central square, Parker House, Spring street, 19 State street.

The Public Water Board propose to lay pipes in the following streets in 1904: Brimblecom street, Holyoke (from Myrtle to Gardiner), Chestnut (from Jefferson to Western avenue), Ken-

wood terrace, Lewis (from Cherry to Ocean), North Franklin (from Boston to Forest Hill avenue), Ocean (from Atlantic to Nahant), Ocean (from Bassett to Swampscott line), Sea street, South (from Common to Summer), Summer (from South to Houghton square), Western avenue (from Houghton square to Car Stable), Summer street (from Burns to the bridge).

Statement.**WATER DEBT.**

Amount of debt, December 19, 1902 . . .	\$2,175,300 00	
Bonds matured and paid in 1903 . . .	8,000 00	
Amount of debt, December 19, 1903 . . .	<u> </u>	\$2,167,300 00

SINKING FUNDS.

Amount of funds, December, 1902 . . .	\$559,769 85	
Received from City Treasurer in year 1903 . . .	83,027 59	
Earnings of sinking funds in year 1903 . . .	20,509 28	
	<u>\$663,306 72</u>	
Deduct bonds paid within year	8,000 00	
	<u>\$655,306 72</u>	
Amount in hands of Treasurer, December 19, 1903; the net income of Water Department for the year 1903	<u>41,127 45</u>	
		<u>696,434 17</u>
		\$1,470,865 83

Water Maintenance.

Treasurer's statement for the year ending December 19, 1903.

RECEIPTS.

From water rates	\$222,076 26
----------------------------	--------------

EXPENDITURES.

For maintenance	\$94,860 07	
For interest	<u>86,088 74</u>	
		<u>180,948 81</u>
Net income for year ending Dec. 19, 1903,		\$41,127 45

Land Purchased.

T. P. & L. F. Hawkes	1 $\frac{80}{100}$ acres
Byron S. Hone	1 $\frac{86}{100}$ acres

Respectfully submitted,

WILLIAM B. LITTLEFIELD, *Pres.*
THOMAS P. NICHOLS,
JAMES BURNS,
CHARLES E. SPRAGUE,
STEPHEN W. DEARBORN.

REPORT OF WATER REGISTRAR.

OFFICE OF THE PUBLIC WATER BOARD, }
 LYNN, MASS., January 1, 1904.

To William B. Littlefield, President

SIR,—I herewith present the financial condition of the department for the year ending December 31, 1903.

RECEIPTS FOR 1903.

Fixtures rates	\$113,344 15	
Meter rates	97,579 70	
Miscellaneous	9,586 28	
Additional rates	1,712 56	
Fines	67 80	
Total revenue	—————	\$222,290 49
Extra pipe		3,049 42
		—————
Total receipts as per cash book		\$225,339 91

COMPARATIVE STATEMENT OF REVENUE.

Amount collected during the year	\$222,290 49
Amount outstanding, fixture rates	\$19,973 39
Amount outstanding, meter rates	7,234 90
Amount outstanding (not due) meter rates	20,999 50
	—————
	48,207 79
	—————
	\$270,498 28
Deduct amount due January 1, 1903	46,057 84
	—————
Revenue for 1903	\$224,440 44
Revenue for 1902	215,692 03
	—————
Increase	\$8,748 41

STATEMENT OF NET EARNINGS FOR 1903.

Revenue	\$224,440 44
EXPENSES.	
Maintenance	\$89,588 39
Interest	86,088 74
Rebate to Saugus	5,056 21
	<hr/>
	180,733 34
Net earnings	\$43 707 10

EXPENDITURES FOR THE YEAR 1903.

MAINTENANCE.

Mains	\$26,583 34
Pumping expenses	15,773 85
Penny Brook road	10,640 64
Salaries and expenses	9,612 54
Meters	6,051 30
Services	5,458 96
Glen Lewis Pond	3,966 55
Stable and shop	3,666 32
Pumping expenses, new station	2,519 40
New station	2,137 23
Engine and boilers, Walnut street	1,263 33
Grading, new station	884 85
Canal	530 74
Damages	233 21
Engine house, Walnut street	196 13
Stand pipe	70 00
Total	<hr/> \$89,588 39

CONSTRUCTION.

Walden Pond dam	\$124,626 76
Services	6,212 53
New station	3,063 90
Engine, new station	1,520 94
Land	595 00
Total	<hr/> \$136,019 13

STATEMENT.

SHOWING COST OF WORKS TO JANUARY 1, 1904.

Mains, hydrants and gates	\$882,706 22
New supply and land	338,595 27
Services and courts	324 341 74
Walden and Glen Lewis Ponds	413,177 85
Engines and boilers	140,327 29
Hawkes Pond	161,036 53
Reservoirs and land	131,581 49
Birch Pond and land	93,471 84
Engine house, pump and conduit, Walden Pond,	83,003 72
Engine house and land	57,562 39
Breed's Pond and land	57,135 28
Pipe conduits and land	81,289 39
Hawkes Pond canal	47,947 33
Force mains and land	41,546 13
Meters	37,531 42
Stand-pipe and pumping machinery	34,274 07
Highland service	12,431 17
Engineering	11,157 95
Tubular wells	9,470 02
Workshop and stable	2,056 97
Compressor	515 00
	<hr/>
	\$2,961,159 07
Less amount received for pipe	150,478 53
	<hr/>
Total net cost	\$2,810,680 54

Following will be found the usual tables, exhibiting the number of buildings, families, stores, factories, etc., supplied with water, the class of premises to which meters are attached, the number and kind of fixtures, the yearly revenues of the department, etc.

Respectfully submitted,

WALLACE O. MUDGE,

Water Registrar.

SERVICES.

Number of services in Lynn	12,006	
Number of services in Saugus	1,037	
Total	<hr/>	13,043
Number put in during the year (Lynn)	196	
Number put in during the year (Saugus)	35	
Total	<hr/>	231
Number extended during the year (Lynn)	28	
Number extended during the year (Saugus)	2	
Total	<hr/>	30
Renewed	76	
Number discontinued	21	
Number not in use	30	
Turned on (new services)	110	
Turned on (reoccupied)	205	
Turned on (repairs)	28	
Shut off (for vacancy)	199	
Shut off (for non-payment)	31	
Shut off (for repairs)	28	

STATEMENT.

SHOWING THE NUMBER OF BUILDINGS TO WHICH WATER IS SUPPLIED,
ALSO THE NUMBER OF FAMILIES, VARIOUS FIXTURES, ETC.,
CONTAINED IN THE SAME, TOGETHER WITH THE
NUMBER OF FIRE HYDRANTS, DEC. 31, 1903.

	LYNN.	SAUGUS.	TOTAL.
Dwellings	12,047	979	13,019
Stores and shops	1,225	46	1,271
Factories	205	3	208
Offices	501	16	517
Restaurants and saloons	77	..	77
School-houses	60	7	67
Churches	32	5	37
Bakeries	30	..	30
Laundries	20	..	20
Engine houses	11	3	14
Families	16,895	1,072	17,967
Boarding-houses	225	2	227
Faucets	31,377	1,865	33,242
Water-closets	14,496	465	14,961
Bath tubs	5,430	351	5,781
Hose bibs	3,225	167	3,492
Urinals	187	8	195
Heaters	330	67	997
Stationary engines	165	7	172
Motors	25	..	25
Greenhouses	16	2	18
Drinking fountains	30	3	33
Stand-pipes for fire purposes	20	1	21
Stand-pipes for water-carts	77	..	77
Sewer connections	25	..	25
Automatic sprinklers	105	3	108
Hydrants	806	160	966
Hydrants for car sprinklers	44	1	45

STATEMENT.

SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST
INTRODUCTION OF WATER INTO THE CITY IN 1871.

From October 1, 1871, to January 1, 1872	.	.	.	.	\$8,989 00
From January 1, 1872, to January 1, 1873	.	.	.	.	27,568 15
From January 1, 1873, to January 1, 1874	.	.	.	.	47,992 61
From January 1, 1874, to January 1, 1875	.	.	.	.	53,545 61
From January 1, 1875, to January 1, 1876	.	.	.	.	52,553 26
From January 1, 1876, to January 1, 1877	.	.	.	.	60,807 12
From January 1, 1877, to January 1, 1878	.	.	.	.	64,002 50
From January 1, 1878, to January 1, 1879	.	.	.	.	67,570 14
From January 1, 1879, to January 1, 1880	.	.	.	.	73,949 80
From January 1, 1880, to January 1, 1881	.	.	.	.	79,635 12
From January 1, 1881, to January 1, 1882	.	.	.	.	80,967 76
From January 1, 1882, to January 1, 1883	.	.	.	.	94,419 52
From January 1, 1883, to January 1, 1884	.	.	.	.	98,893 54
From January 1, 1884, to January 1, 1885	.	.	.	.	114,903 86
From January 1, 1885, to January 1, 1886	.	.	.	.	110,089 11
From January 1, 1886, to January 1, 1887	.	.	.	.	116,573 70
From January 1, 1887, to January 1, 1888	.	.	.	.	123,507 73
From January 1, 1888, to January 1, 1889	.	.	.	.	134,480 77
From January 1, 1889, to January 1, 1890	.	.	.	.	141,865 53
From January 1, 1890, to January 1, 1891	.	.	.	.	154,788 27
From January 1, 1891, to January 1, 1892	.	.	.	.	171,744 85
From January 1, 1892, to January 1, 1893	.	.	.	.	188,979 88
From January 1, 1893, to January 1, 1894	.	.	.	.	177,803 56
From January 1, 1894, to January 1, 1895	.	.	.	.	176,655 50
From January 1, 1895, to January 1, 1896	.	.	.	.	185,572 88
From January 1, 1896, to January 1, 1897	.	.	.	.	190,531 33
From January 1, 1897, to January 1, 1898	.	.	.	.	183,711 97
From January 1, 1898, to January 1, 1899	.	.	.	.	186,658 35
From January 1, 1899, to January 1, 1900	.	.	.	.	193,699 01
From January 1, 1900, to January 1, 1901	.	.	.	.	199,003 54
From January 1, 1901, to January 1, 1902	.	.	.	.	203,078 45
From January 1, 1902, to January 1, 1903	.	.	.	.	215,692 03
From January 1, 1903, to January 1, 1904	.	.	.	.	224,440 44
					<hr/>
					\$4,204,535 40

FUNDED WATER LOAN.

When Payable.			Rate Per Cent.	Amount.
May	1, 1904	.	3½	\$7,300
January	1, 1905	.	5	200,000
January	1, 1905	.	4	150,000
May	1, 1905	.	3½	66,500
December	1, 1905	.	3½	5,000
November	1, 1913	.	4	20,000
November	1, 1914	.	3½	31,000
March	15, 1915	.	4	50,000
December	1, 1914	.	4	20,000
December	1, 1915	.	3½	6,000
April	1, 1916	.	3½	2,000
May	1, 1916	.	3½	24,500
September	1, 1916	.	4	10,000
October	1, 1916	.	4	9,000
February	1, 1917	.	3½	6,500
June	1, 1917	.	3½	3,500
July	1, 1917	.	4	7,500
August	1, 1917	.	4	5,000
October	1, 1917	.	4	2,000
November	1, 1917	.	4	6,500
April	1, 1918	.	4	15,000
June	1, 1918	.	4	10,000
July	1, 1918	.	4	50,000
April	1, 1919	.	4	100,000
July	1, 1919	.	4	110,000
January	1, 1920	.	4	35,000
April	1, 1920	.	4	150,000
April	1, 1921	.	4	50,000
October	1, 1921	.	4	25,000
January	1, 1922	.	4	50,000
July	1, 1922	.	4	25,000
April	1, 1923	.	4	40,000
July	1, 1925	.	4	165,000
July	1, 1926	.	4	50,000
September	1, 1927	.	4	25,000
July	1, 1928	.	4	25,000
October	1, 1928	.	4	10,000
July	1, 1929	.	4	25,000
January	1, 1930	.	4	25,000
October	1, 1930	.	4	25,000
Note (on demand)		.	4	100,000
July	1, 1931	.	4	25,000
January	1, 1932	.	3½	75,000
April	1, 1932	.	3½	325,000
				<hr/>
				\$2,167,300

REPORT OF SUPERINTENDENT.

To the Public Water Board:

GENTLEMEN,—In compliance with the city ordinances I herewith present the annual report of the Superintendent for the year ending December 31, 1903.

Water Supply.

The following ponds have contributed the water supply during the past year :

Ponds.	Gallons.	Gallons.
Breed's	357,614.334	
Birch	604,011.770	
Walden	569,592.500	
Lewis	77,775.250	
Hawkes	244,798.896	
Total pumpage in 1903	<hr/>	1,873,992.750
Total pumpage in 1902		1,709,855.000
Increase of pumpage the past year .		<hr/> 164,137.750
Total consumption of water the past year		1,875,197.646
Total consumption of water in 1902,		1,709,855.000
Increase of consumption the past year		<hr/> 165,342.646

The average consumption of water per day of 5,137,527 gallons with an average daily increase of 452,993 gallons or nearly one-half million gallons per day. If we should figure the consumption of water the past year on the same basis per capita as in 1902, which was 62.42 gallons to each inhabitant per day, it would give Lynn and Saugus a population of 81,000.

The analysis of water from the several ponds has been made in the laboratory the past year, which show less organisms than during any preceding year.

Walden Pond Dam.

The work of raising the dam has been in progress nearly two years, which is of considerable magnitude and requires constant vigilance and care, to which the members of the Board have been faithful in the discharge of their duties.

The city is fortunate in having members on the Board who are thoroughly interested in our water supply, and who are able to give so much time and attention to the work. In a growing city like ours it requires men capable of looking forward to the future needs of the city.

After the completion of the dam the Walden Pond basin will have a storage capacity of 1,754,157,073 gallons with a total storage capacity of 2,294,619,445 gallons, showing an increase over the present supply of 1,230,516,076 gallons equal to a daily supply of 3,333,000 gallons.

It was estimated that the increased supply of water would be sufficient to last Lynn for seventeen years. It will depend entirely upon the increase of population. If the population of the city should increase as rapidly as it has since the last census was taken, and the consumption of water continues to increase as in the past year (which was 452,993 gallons per day) the supply would hardly be sufficient to serve the city seventeen years, and it would be necessary to connect with Ipswich River for an additional water supply.

However large the population may be the Water Board will endeavor to see that the city has an abundant supply of water.

New Roads.

Nearly two miles of road have been built the past year, which will add much to the attraction of the park. The construction and completion of the road has been ably presented by the President in his report.

Grubbing.

The work of grubbing the shores and graveling the bottom of the ponds have been beneficial to the water. It has reduced the color, also the growth which have been slight the past year, and

when the work is completed the growths will not be considered objectionable.

Pumping Station.

The grounds around the station have been greatly improved the past year. This work will be carried along each year to make the surroundings more attractive.

The pumps were started up to fill the ponds and continued to run twenty-five days pumping 202,492,500 gallons of water into Birch Pond and 254,086,250 gallons into Walden Pond. The pumps were run twenty-nine revolutions per minute, delivering nearly twenty million gallons per day, which is two-thirds the capacity of the pumps. Had they been run to their fullest capacity the work would have been accomplished in seventeen days.

New Main Pipes.

Main pipes extended and pipes renewed have been laid in the following streets :

New Streets.

Fosdick terrace, 216 feet; Stanley terrace, 248 feet.

Pipe Extension.

Western avenue (from car stable to Fairchild street), 531 feet; Tracy avenue, 48 feet; Board of Health stable (Gas House road) 360 feet; cement-lined pipe removed and relaid with cast-iron pipe in Beede avenue, 400 feet; Elizabeth street, 178 feet; Chatham street (from Silsbee avenue to Eutaw avenue), 959 feet; Broad street (from Exchange to Atlantic), 2,323 feet; Ocean street (from Bassett to Atlantic), 1,748 feet; Carnes street 872 feet; School street 453 feet; Ellis street 385 feet; Pearl street 790 feet.

Pipe removed and relaid in Western avenue for B. & N. R. Co. on account of lowering grade of the street 600 feet; this expense was borne by the B. & N. R. R.

Pipe removed and relaid in Bay View avenue for Sewer Department, on account of sewer trench running close to main pipe, and to protect pipe from damage by blasting ledge which extended the entire length of pipe laid which was 500 feet. The work was done at the expense of Water Department.

Services.

New services in Lynn	196
New services in Saugus	35
Number feet lead-lined pipe	7,900
Number feet galvanized iron pipe	2,066
Number of services renewed	76
Number of services extended	23
Number of services discontinued	21
Number of services changed from old main to new	104
New service boxes in place of old	23
Services boxes repaired	60
Number of leaks repaired	230
Number of services frozen	33
Number of services lowered	11
Court services changed for Sewer Department	2
Service pipes bushed out	1,735
Lead connections renewed with corporation cocks	132
Lead connections renewed without corporation cocks,	28

Meters.

New meters	382
Meters repaired	471
Meters changed	67
Meters reset	12
Meters exchanged	26
Meters frozen	21
New meter boxes	4
New meter boxes to replace old ones	10
Meter boxes repaired	14

During the year 22 new gates have been set in connection with new mains and 15 gates repaired. Twenty-two new gate-boxes have been set in connection with new mains, 21 to replace old ones, 17 gate boxes repaired. One new sprinkling hydrant, 22 sprinkling hydrants repaired, one new fire hydrant put in, three new fire hydrants to replace old ones, 60 fire hydrants were repaired and 94 pipe leaks.

Respectfully submitted,

D. A. SUTHERLAND,

Superintendent.

Microscopical Examination of Water from Birch Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . . .	43750	44143	44497	44885	45274	45744	46252	46717	47103	47566	48032	48554
Plants.												
DIATOMACEÆ:	12	17	6	370	910	704	152	2073	272	545	1033	78
Asterionella	0	1	0	50	120	37	51	1600	176	15	35	15
Cyclotella	0	1	0	1	44	52	9	2	2	2	2	1
Melosira	0	0	4	50	39	30	0	11	44	102	2	1
Synedra	0	0	0	37	26	1	5	0	0	5	46	14
Tabellaria	12	9	1	180	435	774	55	470	45	410	555	20
CYANOPHYCÆ:	0	0	0	1	0	4	12	43	15	3	4	0
Anabena	0	0	0	0	0	3	0	10	15	3	4	0
Merismopedia	0	0	0	0	0	0	12	30	0	0	0	0
ALGÆ:	0	4	0	40	35	24	47	52	58	74	12	5
Animals.												
INFUSORIA:	5	12	123	134	18	35	39	62	45	6	25	51
Dinobryon	0	0	75	111	14	0	31	30	15	2	20	41
Euglena acus	0	0	14	0	0	0	1	0	0	0	0	0
Glenodinium	6	4	3	3	0	0	0	43	4	0	0	0
Peridinium	0	4	15	2	0	1	1	0	0	0	0	0
Raphidomonas	0	0	0	0	0	24	0	0	14	0	0	0
Synura	0	0	2	4	0	0	0	0	0	0	0	0
VERMES:	0	2	0	2	0	0	0	0	0	0	5	1
CRUSTACEA:	0	0	0	0	0	0	0	0	pr.	pr.	0	pr.
Bosmina	0	0	0	pr.	pr.	pr.	0	pr.	pr.	pr.	pr.	pr.
Cyclops	0	0	0	0	0	0	0	0	0	0	0	0
Daphnia	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS:	3	5	2	5	5	3	5	5	5	5	5	5
Zoogaea	3	5	2	5	5	3	5	5	5	5	5	5
Total	23	40	131	573	971	800	255	2265	420	1150	159	102

Microscopical Examination of Water from Breeds Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43751	44144	44498	44886	45275	45745	46253	46718	47104	47567	48033	48379
Plants.												
DIATOMACEÆ:	5	59	27	58	504	145	1598	580	37	52	79	71
Asterionella	0	0	0	3	38	70	1032	306	26	11	38	59
Synedra	1	56	0	23	212	14	0	0	0	0	7	10
Tabellaria	4	0	18	29	254	61	562	184	10	32	29	1
CYANOPHYCÆ:	0	1	2	0	0	23	128	0	0	5	0	0
Anabæna	0	0	0	0	0	23	96	0	0	5	0	0
Merismopedia	0	0	0	0	0	0	32	0	0	0	0	0
ALGÆ:	0	2	0	10	48	47	58	8	11	14	7	8
Animals.												
INFUSORIA:	10	145	44	14	34	19	20	26	10	15	5	1
Dinobryon	0	16	36	11	34	1	4	2	1	9	1	0
Glenodinium	0	126	2	0	0	0	0	20	1	4	0	0
VERMES:	0	0	1	1	4	1	0	0	0	0	0	1
CRUSTACEA:												
Bosmina	0	0	0	0	0	pr.	0	0	0	0	0	0
Cyclops	0	0	pr.	pr.	pr.	pr.	pr.	pr.	0	0	pr.	0
MISCELLANEOUS:												
Zoogloeæ	5	5	3	5	5	3	5	3	5	5	4	5
Total	20	212	77	88	595	238	1809	617	63	91	95	86

Microscopical Examination of Water from Glen Lewis Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	February 13.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.
Number of Sample . . .	44207	44400	44587	45270	45740	46255	46719	47105
Plants.								
DIATOMACEÆ:	17	2	37	33	14	2	15	1019
Synedra	12	0	5	0	0	0	1	384
CYANOPHYCÆ:	5	0	5	2	179	5	0	17
Anabæna	0	0	0	0	175	0	0	17
ALGÆ:	0	0	50	5	1	20	15	17
Animals.								
INFUSORIA:	48	74	327	1	22	2	31	555
Dinobryon	0	15	255	0	0	0	0	5
Euglena	0	0	15	0	0	0	0	4
Glenodinium	30	22	0	0	0	0	3	516
Synura	0	24	0	0	0	0	0	0
Trachelomonas	1	0	0	1	0	0	31	20
Vorticella	0	0	1	0	15	0	0	1
VERMES	0	1	1	0	0	0	0	2
CRUSTACEA:								
Bosmina	0	0	0	pr.	0	0	0	0
MISCELLANEOUS:								
Zoogloa	5	2	5	3	3	3	5	5
Total	75	79	425	44	219	32	74	1022

Microscopical Examination of Water from Hawkes Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43752	44145	44500	44888	45277	45747	46254	46720	47106	47568	48034	48380
Plants.												
DIATOMACEÆ:	87	14	7	46	161	122	43	50	142	99	99	17
Asterionella	21	8	4	2	124	40	21	0	55	40	17	1
Cyclotella	66	6	2	4	30	68	13	6	0	2	5	0
Tabellaria	0	0	0	20	2	14	3	39	77	53	58	15
CYANOPHYCEÆ:	0	0	0	0	0	24	0	7	0	0	0	0
Anabæna	0	0	0	0	0	20	0	0	0	0	0	0
ALGÆ:	0	0	0	4	5	36	6	3	4	4	8	1
Animals.												
INFUSORIA:	0	1	10	23	2	0	143	32	30	10	25	323
Dinobryon	0	0	3	17	0	0	138	0	2	10	23	321
Glenodinium	0	1	0	2	0	0	0	25	20	0	0	1
VERMES:	1	0	1	1	1	0	0	0	0	0	0	0
CRUSTACEA:												
Sida	0	0	0	0	0	0	pr.	0	0	0	0	0
MISCELLANEOUS,												
Zoogloea	3	2	3	5	3	3	5	3	5	4	3	3
Total	91	17	21	79	172	185	197	95	181	117	135	344

Microscopical Examination of Water from Walden Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	April 9.	May 13.	June 10.	July 15.	August 12.
Number of Sample	44889	45274	45740	46256	46721
Plants.					
DIATOMACEÆ:	28	262	42	139	429
Asterionella	2	170	0	5	72
Cyclotella	11	65	30	25	3
Tabellaria	11	1	5	68	300
CYANOPHYCÆ:	4	0	405	191	14
Anabaena	0	0	404	1	4
Chroococcus	4	0	0	190	0
ALGÆ:	5	47	115	18	36
Raphidium	3	39	72	0	16
Animals.					
INFUSORIA:	37	44	26	82	24
Dinobryon	30	35	0	3	10
Mallomonas	1	0	0	74	0
Monas	0	1	14	2	4
Synura	0	0	0	0	1
Vorticella	0	0	10	0	0
VERMES:	1	1	1	0	0
CRUSTACEA:					
Bosmina	0	pr.	0	0	0
Cyclops	pr.	pr.	0	0	0
MISCELLANEOUS					
Zooglyea	5	3	5	5	10
Total	83	157	622	435	513

Microscopical Examination of Water from Saugus River at Montrose.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43754	44146	44501	44850	45279	45748	46257	46722	47107	47569	48035	48381
Plants.												
DIATOMACEÆ:	7	4	15	9	26	57	12	27	11	0	4	1
CYANOPHYCEÆ:	0	0	0	0	0	4	0	0	0	0	0	0
ALGÆ:	0	0	2	0	2	58	4	1	0	0	8	0
Animals.												
INFUSORIA:	7	9	39	10	0	6	3	1	0	1	0	5
Chlamydomonas . .	0	0	10	2	0	0	0	0	0	0	0	0
Dinobryon	6	8	22	4	0	0	1	0	0	0	0	4
Synura	0	0	1	0	0	0	0	0	0	0	0	0
Uroglena	0	0	0	0	0	1	0	0	0	0	0	0
VERMES:	0	0	0	0	0	0	0	0	0	0	0	1
CRUSTACEA												
Cyclops	0	0	0	0	0	pr.	0	0	0	0	0	0
MISCELLANEOUS, Zooglaea	0	3	3	3	3	3	5	2	3	3	3	3
Total	14	16	59	22	31	128	24	34	82	10	15	10

Microscopical Examination of Water from a Faucet in Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination, 1903.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	October 9.	November 14.	December 12.
Number of Sample . .	3504	3591	3927	30036	30999	40407	41005	41584	42640	43163	43475
Plants.											
DIATOMACEÆ:	9	6	4	30	250	120	378	150	106	17	1
Melosira	0	0	0	0	0	0	11	3	107	0	0
Tabellaria	0	4	0	13	140	120	344	150	32	4	0
CYANOPHYCEÆ:	0	0	0	0	0	0	4	1	3	1	0
ALGÆ:	0	0	0	2	5	2	12	1	11	2	0
Animals.											
INFUSORIA:	4	1	6	25	11	1	63	1	2	0	1
Dinobryon	0	0	5	24	7	0	63	0	1	0	0
VERMES:	0	0	0	0	2	0	2	0	0	0	0
MISCELLANEOUS.											
Zooglena	3	3	3	5	5	3	5	10	5	3	3
Sponge spicules . .	0	0	0	0	0	0	0	1	0	0	0
Total	10	10	13	71	255	120	404	173	131	23	5

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1903.

MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	167,061,707	5,389,732	834,591	. . . . .	66.54	67.37
February	147,391,488	5,260,410	872,029	. . . . .	64.94	65.76
March	154,420,625	4,981,311	725,564	. . . . .	61.50	62.27
April	146,257,006	4,875,233	576,955	. . . . .	60.19	60.94
May	164,865,100	5,318,229	777,448	. . . . .	65.66	66.48
June	152,272,822	5,075,761	121,386	. . . . .	62.66	63.45
July	169,190,736	5,457,766	474,672	. . . . .	67.38	68.22
August	159,828,641	5,155,762	104,077	. . . . .	63.65	64.45
September	154,070,758	5,135,693	484,073	. . . . .	63.40	64.20
October	154,570,295	4,936,138	354,734	. . . . .	61.56	62.33
November	143,687,392	4,789,580	222,951	. . . . .	59.13	59.87
December	161,661,046	5,214,872	205,202	. . . . .	64.38	65.19
Totals and averages	1,875,197,646	5,137,527	452,993	. . . . .	63.43	64.22

Basis: Population, Lynn and Saugus, 51,000,

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1903.

MONTH.	GALLONS.					Total.
	Breed's.	Birch.	Walden.	Lewis.	Hawkes.	
January .	5,752,000		130,695,250		30,147,250	166,624,500
February .		35,120,750	112,932,750			148,053,500
March . .	85,177,313	68,719,437				153,896,750
April . . .	89,343,333	54,202,107				143,545,440
May	6,376,125	162,428,575				168,804,700
June	23,655,375	126,144,375				149,800,750
July	16,121,000		153,375,000			169,496,000
August . . .			160,435,250			160,435,250
September .		44,735,000	32,150,250	68,440,570		145,320,820
October . .	68,314,167	81,674,833		9,285,500		159,274,500
November .	63,015,021	25,080,333			54,535,140	143,630,494
December .					150,515,500	150,515,500
Totals . . .	357,514,334	614,011,770	582,592,500	77,725,250	244,795,260	1,876,639,154

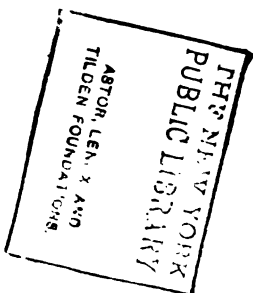


GALLONS.

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1903.

MONTH.	GALLONS.					Total.
	Breed's.	Birch.	Walden.	Lewis.	Hawkes.	
January . . .	5,782,000		130,005,250		30,147,250	165,934,500
February . . .		35,120,750	112,030,750			147,151,500
March . . .	85,177,313	68,719,437				153,896,750
April . . .	89,343,333	54,802,167				144,145,500
May . . .	6,376,125	102,428,875				108,805,000
June . . .	23,085,375	126,144,375				149,229,750
July . . .	16,121,000		153,370,000			169,491,000
August . . .			166,438,250			166,438,250
September . .		40,735,000	32,156,250	68,480,570		141,371,820
October . . .	68,314,167	81,674,833		9,285,500		159,274,500
November . . .	63,015,021	25,686,333			54,835,140	143,536,500
December . . .					156,818,500	156,818,500
Totals . .	357,514,334	604,011,770	589,592,500	77,775,250	244,796,890	1,873,690,750



GALLONS.

Microscopical Examination of Water from Birch Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43750	44143	44497	44885	45274	45744	46252	46717	47103	47566	48032	48379
Plants.												
DIATOMACEÆ:	12	17	6	370	910	704	152	2073	272	546	1131	74
Asterionella	0	1	0	50	120	37	51	1600	176	15	15	15
Cyclotella	0	1	0	1	44	54	9	2	2	2	2	1
Melosira	0	0	4	50	30	30	0	11	44	102	25	3
Synedra	0	0	0	57	265	1	5	0	0	4	45	14
Tabellaria	12	9	1	150	435	274	53	470	48	410	550	30
CYANOPHYCÆ:	0	0	0	1	0	4	12	43	15	3	4	0
Anabæna	0	0	0	0	0	3	0	10	15	3	4	0
Merismopedia	0	0	0	0	0	0	12	30	0	0	0	0
ALGÆ:	0	4	0	40	38	24	47	52	88	74	32	5
Animals.												
INFUSORIA:	8	12	123	134	18	35	39	92	45	6	25	51
Dinobryon	0	0	78	111	14	0	31	30	15	2	20	41
Euglena acus	0	0	14	0	0	0	1	0	0	0	0	0
Glenodinium	0	4	3	3	0	0	0	43	4	0	0	6
Peridinium	0	4	15	2	0	1	1	0	0	0	0	0
Raphidomonas	0	0	0	0	0	24	0	0	14	0	0	0
Synura	0	0	2	4	0	0	0	0	0	0	0	0
VERMES:	0	2	0	3	0	0	0	0	0	0	5	0
CRUSTACEA:												
Bosmina	0	0	0	0	0	0	0	pr.	pr.	0	pr.	
Cyclops	0	0	0	pr.	pr.	pr.	0	pr.	pr.	pr.	pr.	pr.
Daphnia	0	0	0	0	0	0	0	0	0	0	pr.	
MISCELLANEOUS:												
Zoogæa	3	5	2	5	5	3	5	5	5	5	5	5
Total	23	42	131	573	971	800	255	2275	420	1150	1876	162

Microscopical Examination of Water from Breeds Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43751	44144	44498	44886	45275	45745	46253	46718	47104	47567	48033	48379
Plants.												
DIATOMACEÆ:	5	59	27	58	504	145	1598	580	37	52	79	71
Asterionella	0	0	0	3	38	70	1032	396	26	11	38	59
Synedra	1	56	9	23	212	14	0	0	0	0	7	10
Tabellaria	4	0	18	29	254	61	562	184	10	32	20	1
CYANOPHYCÆ:	0	1	2	0	0	23	128	0	0	5	0	0
Anabæna	0	0	0	0	0	23	96	0	0	5	0	0
Merismopedia	0	0	0	0	0	0	32	0	0	0	0	0
ALGÆ:	0	2	0	10	48	47	58	8	11	14	7	8
Animals.												
INFUSORIA:	10	145	44	14	34	19	20	26	10	15	5	1
Dinobryon	0	16	36	11	34	1	4	2	1	9	1	0
Glenodinium	0	126	2	0	0	0	0	20	1	4	0	0
VERMES:	0	0	1	1	4	1	0	0	0	0	0	1
CRUSTACEA:												
Bosmina	0	0	0	0	0	pr.	0	0	0	0	0	0
Cyclops	0	0	pr.	pr.	pr.	pr.	pr.	pr.	0	0	pr.	0
MISCELLANEOUS:												
Zoogloæa	5	5	3	5	5	3	5	3	5	5	4	5
Total	20	212	77	88	595	238	1809	617	63	91	95	86

Microscopical Examination of Water from Glen Lewis Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	February 13.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.
Number of Sample . . .	44207	44400	44887	45276	45746	46255	46714	47105
Plants.								
DIATOMACEÆ:	17	2	37	33	14	2	15	1019
Synedra	12	0	5	0	0	0	1	084
CYANOPHYCEÆ:	5	0	5	2	179	5	0	17
Anabana	0	0	0	0	175	0	0	17
ALGÆ:	0	0	50	5	1	20	15	17
Animals.								
INFUSORIA:	45	74	327	1	22	2	31	555
Dinobryon	0	15	255	0	0	0	0	5
Euglena	0	0	15	0	0	0	0	4
Glenodinium	36	22	0	0	0	0	3	516
Synura	0	24	0	0	0	0	0	0
Trachelomonas	1	0	0	1	0	0	31	29
Vorticella	0	0	1	0	15	0	0	1
VERMES	0	1	1	0	0	0	0	2
CRUSTACEA:								
Bosmina	0	0	0	pr.	0	0	0	0
MISCELLANEOUS:								
ZOOGLA	5	2	5	3	3	3	5	5
Total	75	79	425	44	219	32	74	1622

Microscopical Examination of Water from Hawkes Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43752	44145	44500	44888	45277	45747	46254	46720	47106	47568	48034	48380
Plants.												
DIATOMACEÆ:	87	14	7	46	161	122	13	50	142	99	99	17
Asterionella	21	8	4	2	124	40	21	0	55	40	17	1
Cyclotella	66	6	2	4	30	68	13	6	6	2	5	0
Tabellaria	0	0	0	20	2	14	3	39	77	53	58	15
CYANOPHYCEÆ:	0	0	0	0	0	24	0	7	0	0	0	0
Anabæna	0	0	0	0	0	20	0	0	0	0	0	0
ALGÆ:	0	0	0	4	5	36	6	3	4	4	8	1
Animals.												
INFUSORIA:	0	1	10	23	2	0	143	32	30	10	25	323
Dinobryon	0	0	3	17	0	0	138	0	2	10	23	321
Glenodinium	0	1	0	2	0	0	0	25	20	0	0	1
VERMES:	1	0	1	1	1	0	0	0	0	0	0	0
CRUSTACEA:												
Sida	0	0	0	0	0	0	pr.	0	0	0	0	0
MISCELLANEOUS,												
Zoogla	3	2	3	5	3	3	5	3	5	4	3	3
Total	91	17	21	79	172	185	197	95	181	117	135	344

Microscopical Examination of Water from Walden Pond, Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	April 9.	May 13.	June 10.	July 15.	August 12.
Number of Sample	44389	45274	45749	47256	47731
Plants.					
DIATOMACEÆ:	28	202	42	130	429
Asterionella	2	170	0	5	72
Cyclotella	11	65	30	24	3
Tabellaria	11	1	5	68	300
CYANOPHYCÆ:	4	0	405	191	14
Anabaena	0	0	404	1	4
Chroococcus	4	0	0	190	0
ALGÆ:	8	47	115	18	36
Raphidium	3	30	72	0	10
Animals.					
INFUSORIA:	37	44	20	80	24
Dinobryon	30	35	0	3	10
Mallomonas	1	0	0	74	0
Monas	6	1	14	2	4
Synura	0	0	0	0	1
Vorticella	0	0	10	0	0
VERMES:	1	1	1	0	0
CRUSTACEA:					
Bosmina	0	pr.	0	0	0
Cyclops	pr.	pr.	0	0	0
MISCELLANEOUS:					
Zoogloea	5	3	5	5	10
Total	83	357	600	435	513

Microscopical Examination of Water from Saugus River at Montrose.

Number of Organisms per Cubic Centimeter.

Day of Examination. 1903.	January 15.	February 11.	March 11.	April 9.	May 13.	June 10.	July 15.	August 12.	September 10.	October 14.	November 11.	December 10.
Number of Sample . .	43754	44146	44501	44850	45279	45748	46257	46722	47107	47569	48035	48381
Plants.												
DIATOMACEÆ:	7	4	15	9	26	57	12	27	11	0	4	1
CYANOPHYCÆÆ:	0	0	0	0	0	4	0	0	0	0	0	0
ALGÆ:	0	0	2	0	2	58	4	1	0	0	8	0
Animals.												
INFUSORIA:	7	9	39	10	0	6	3	1	0	1	0	5
Chlamydomonas . .	0	0	10	2	0	0	0	0	0	0	0	0
Dinobryon	6	8	22	4	0	0	1	0	0	0	0	4
Synura	0	0	1	0	0	0	0	0	0	0	0	0
Uroglena	0	0	0	0	0	1	0	0	0	0	0	0
VERMES:	0	0	0	0	0	0	0	0	0	0	0	1
CRUSTACEA												
Cyclops	0	0	0	0	0	pr.	0	0	0	0	0	0
MISCELLANEOUS, Zooglicea	0	3	3	3	3	3	5	2	3	3	3	3
Total	14	16	59	22	31	128	24	34	82	10	15	10

Microscopical Examination of Water from a Faucet in Lynn.

Number of Organisms per Cubic Centimeter.

Day of Examination, 1903.	January 9.	February 12.	March 12.	April 15.	May 13.	June 13.	July 12.	August 13.	October 9.	November 14.	December 12.
Number of Sample . .	38504	38991	39271	39636	39999	40407	41008	41554	42649	43163	43405
Plants.											
DIATOMACEÆ:	0	6	4	30	250	120	378	150	160	17	1
Melosira	0	0	0	0	63	0	11	3	107	0	0
Tabellaria	0	4	0	13	146	120	344	156	32	4	0
CYANOPHYCEÆ:	0	0	0	0	0	0	4	1	3	1	0
ALGÆ:	0	0	0	2	5	2	12	1	11	2	0
Animals.											
INFUSORIA:	4	1	6	25	11	1	63	1	2	0	1
Dinobryon	0	0	5	24	7	0	63	0	1	0	0
VERMES:	0	0	0	0	2	0	2	0	0	0	0
MISCELLANEOUS.											
Zooglaa	3	3	3	5	5	3	5	10	5	3	3
Sponge spicules . .	0	0	0	0	0	0	0	1	0	0	1
Total	10	10	13	71	285	120	404	173	181	23	5

TABLE I.

CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1903.

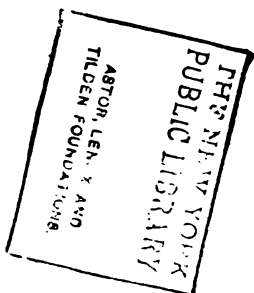
MONTH.	GALLONS.					
	Monthly consumption.	Average consumption per day.	Average daily increase.	Average daily decrease.	Average to each inhabitant.	Average to each consumer.
January	167,081,707	5,389,732	834,591	. . . . .	66.54	67.37
February	147,291,488	5,260,410	872,029	. . . . .	64.94	65.76
March	154,420,625	4,981,311	725,564	. . . . .	61.50	62.27
April	146,257,006	4,875,233	576,955	. . . . .	60.19	60.94
May	164,865,100	5,318,229	777,448	. . . . .	65.66	66.48
June	152,272,822	5,075,761	121,386	. . . . .	62.66	63.45
July	169,190,736	5,457,766	474,672	. . . . .	67.38	68.22
August	159,828,641	5,155,762	104,077	. . . . .	63.65	64.45
September	154,070,788	5,135,693	484,073	. . . . .	63.40	64.20
October	154,570,295	4,986,138	354,734	. . . . .	61.56	62.33
November	143,687,392	4,789,580	222,951	. . . . .	59.13	59.87
December	161,661,046	5,214,872	205,202	. . . . .	64.38	65.19
Totals and averages	1,875,197,646	5,137,527	452,993	. . . . .	63.43	64.22

Basis: Population, Lynn and Saugus, 51,000,

TABLE II.

AMOUNT OF WATER DRAWN FROM EACH SOURCE DURING THE YEAR 1903.

MONTH.	GALLONS.					Total.
	Breed's.	Birch.	Walden.	Lewis.	Hawkes.	
January . .	5,782,000		130,005,250		30,147,250	165,934,500
February . .		35,120,750	112,032,750			147,153,500
March . . .	85,177,313	68,719,437				153,896,750
April . . .	89,343,333	54,202,167				143,545,500
May	6,376,125	162,428,575				168,804,700
June	23,685,375	126,144,375				149,829,750
July	16,121,000		153,370,000			169,491,000
August . . .			160,435,250			160,435,250
September .		40,735,000	32,150,250	68,480,570		141,360,820
October . .	68,314,167	81,074,833		9,285,500		158,674,500
November . .	63,015,021	25,080,333			54,538,146	142,633,500
December . .					150,818,500	150,818,500
Totals . . .	357,514,334	634,011,770	589,592,500	77,775,250	244,795,800	1,863,693,750



GALLONS.



TABLE III.

RAINFALL AT THE PUMPING STATION FOR 1903.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	.	.	.	.	.	.	.	.	.	0.07	.	.
2	0.55	0.19	.	0.12	.	.	.	.	.	.	.	*0.25
3	0.05	0.09	.	0.09	0.34	.	.	.	.	.	.	*0.04
4	*0.02	0.88	.	0.30	0.03	.	.	0.47	.	.	.	.
5	.	.	0.20	.	0.18	.	.	0.45	0.40	0.26	0.29	.
6	*0.43	.	.	0.03	.	.	0.02	0.17	.	.	*0.16	.
7	*0.07	.	0.21	0.27	.	.	0.30	0.03	.	0.20	.	.
8	.	0.45	1.33	1.10	.	0.54	.	.	.	.	.	.
9	.	.	1.18	0.38	.	0.07	.	0.03	.	.	.	0.98
10	.	.	0.15	.	.	0.01	.	.	.	0.70	.	.
11	*0.63	0.42	0.42	.	.	0.09	.	.	.	0.95	.	.
12	.	.	.	.	.	0.85	0.02	.	.	0.64	.	.
13	.	.	.	.	.	0.03	.	.	.	.	.	0.24
14	.	.	.	0.05	0.03	.	0.03	.	.	.	.	.
15	.	*0.33	.	2.04	.	2.96	.	0.16	.	.	.	.
16	.	*1.52	.	0.09	.	.	.	.	0.37	.	0.70	.
17	.	*0.12	.	0.05	.	.	.	.	0.12	1.26	0.26	.
18	.	.	.	.	.	.	0.96	.	.	.	.	.
19	.	.	.	.	.	.	0.10	.	.	.	.	.
20	0.27	.	.	.	.	0.45	.	0.07	.	.	.	0.50
21	0.80	.	0.70	.	.	2.26	0.17	.	.	.	.	*0.03
22	.	.	0.55	.	.	0.05	0.11	.	.	.	.	.
23	.	.	0.62	.	.	.	0.03	.	.	.	.	.
24	*0.05	.	.	.	.	0.42	.	.	0.02	.	.	.
25	*0.20	.	.	.	.	.	0.02	0.52	.	.	.	.
26	.	.	.	.	.	.	.	.	.	.	.	*0.09
27	.	0.28	.	.	.	.	.	.	0.70	.	.	.
28	0.05	0.09	0.10	.	0.07	.	.	0.10	.	.	.	.
29	0.06	.	.	.	0.02	0.28	0.23	.	.	.	.	*0.21
30	0.35	.	1.42	.	.	0.05	0.75	0.62	.	.	.	.
31	.	.	.	.	.	.	.	0.03	.	.	.	.
Total	3.83	4.37	6.18	4.52	0.37	8.56	2.76	2.65	1.61	4.08	1.41	2.34

* Snow.

Total for the year 42.68.

TABLE IV.

SHOWING THE RAINFALL AT THE CITY HALL FOR 1903.

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1										.05		
2		.08		.08								.02
3												.02
4			.71	.25	.03			.41				.02
5			.14					.30				.02
6		.37			.22		.16	.22	.39	.19	.24	.02
7			.10							.15	.12	
8	.01	.33	1.18	.08		.52						
9			.13	1.03		.09						.02
10			.14	.40						.52		
11	.52	.26	.18			.07					.01	
12						.70				.56		
13						.03						.19
14					.03		.04					
15		.06		2.05		3.01						
16		.68		.03				.15	.20		.02	
17		.01						.13	.13	1.06	.22	
18							.70					
19							.09	.01				
20	.34					.74		.12				.02
21	.60		.67			2.15	.17					.02
22			.44			.01	.14					.02
23			.60									
24	.02					.40						
25	.14							.53				.02
26												
27		.22							.70			
28	.07		.12					.08				
29					.04	.31	.18					.15
30	.20		1.40			.03	.70	.45				
31												
Total	3.16	2.49	5.19	3.95	.32	8.18	2.30	2.36	1.51	3.51	1.21	1.99

* Snow.

Total for the year, 39.07.

TABLE V.

SHOWING THE DEPTH OF WATER IN PONDS FOR EACH WEEK DURING 1903.

DATE.	FEET.				
	Hawkes Pond.	Breed's Pond.	Birch Pond.	Walden Pond.	Glen Lewis Pond.
January 5	23.7	13.5	10.3	5.10	9.5
January 12	23.7	13.10	11.6	3.8	10.5
January 19	24.6	14.5	11.9	. . .	10.9
January 26	22.9	14.5	10.6	. . .	11.
February 1	22.10	15.7	9.10	. . .	10.4
February 8	24.	16.4	9.9	. . .	11.
February 15	23.10	16.9	10.	. . .	12.10
February 22	22.8	17.6	9.6	. . .	13.6
March 1	22.11	17.9	9.6	. . .	14.10
March 8	23.2	18.5	9.10	. . .	15.
March 15	24.8	19.8	10.1	6.1	15.7
March 22	22.9	19.7	10.9	7.	16.8
March 29	22.10	19.6	11.6	12.7	18.1
April 5	22.10	19.1	16.2	15.7	18.1
April 12	23.4	19.4	19.6	16.2	18.1
April 19	26.	20.1	20.8	16.8	18.1
April 26	26.	19.9	20.6	16.8	18.1
May 3	26.	19.	20.	16.8	18.
May 10	25.10	19.3	19.9	15.7	17.9
May 17	25.9	19.3	19.8	15.7	17.9
May 24	25.6	19.3	17.10	15.6	17.8
May 31	25.5	19.2	17.	15.6	17.6
June 6	25.	19.1	15.3	14.11	17.4
June 13	24.9	19.3	16.5	13.3	18.
June 20	26.3	20.7	16.10	14.9	19.
June 27	25.9	20.3	17.10	15.7	19.2
July 4	25.11	19.10	18.9	14.11	19.2
July 11	25.9	19.3	18.6	14.9	18.10
July 18	25.7	19.	17.8	14.7	18.1
July 25	25.11	19.2	17.10	13.5	18.
August 1	25.8	19.2	17.10	11.8	17.10
August 8	25.7	19.3	16.8	10.	17.
August 15	25.6	19.4	16.7	9.	17.
August 22	25.4	19.	15.1	7.10	17.
August 29	25.2	18.10	13.9	6.5	16.8
September 5	25.	18.	11.9	. . .	16.4
September 12	24.8	18.6	10.9	. . .	15.
September 19	24.6	18.	10.9	. . .	11.9
September 26	24.4	17.8	10.8	. . .	8.
October 3	24.4	17.6	10.7	. . .	7.1
October 10	24.3	17.4	10.9	. . .	5.9
October 17	24.5	17.4	9.6	. . .	7.2
October 24	24.6	17.	9.	. . .	8.2
October 31	24.7	16.8	8.	. . .	6.
November 7	25.2	16.5	8.3	. . .	. . .
November 14	22.1	16.3	9.3	. . .	. . .
November 21	22.1	15.10	8.7	. . .	. . .
November 28	21.6	15.2	8.6	. . .	. . .
December 5	21.6	14.8	8.6	. . .	. . .
December 12	18.9	13.8	8.6	. . .	. . .
December 19	18.	13.2	8.8	. . .	. . .
December 26	15.10	12.4	8.9	3.6	3.2

TABLE VI.

SHOWING THE LOCATION OF GATES SET IN 1903.

STREET.	LOCATION.
Broad.....	On north line of Nahant street, $16\frac{3}{4}$ feet west from east line of Broad street.
Chatham.....	At junction of Eutaw avenue.
School	On north line, $12\frac{2}{3}$ feet east from west line of School street.
Western avenue .	$45\frac{1}{3}$ feet from stone post on the northerly line of Fairchild street.
Western avenue .	6-inch gate between the Highland main, to connect the 10-inch main, 37 feet south from No. 391, and 19 feet, 6 inches east from west line.
Western avenue .	6-inch gate between the Highland main, to connect the 10-inch main, 20 feet east of west line of Western avenue, at No. 461—3 feet south from the south corner of the stone steps.

TABLE VII.

SHOWING THE KIND, SIZE AND NUMBER OF WATER METERS IN USE.

KIND.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	1 $\frac{1}{2}$ in.	2 in.	3 in.	4 in.	Total
Trident	765	830	95	5	5	...	...	1,700
Thomson	173	357	77	14	3	1	1	626
Lambert	337	291	31	4	18	...	...	681
Hersey	80	65	2	1	1	...	...	149
Ball and Fitts	29	28	16	...	...	...	...	73
Union	3	21	6	7	8	...	11	56
Nash	57	14	1	...	1	...	...	73
Niagara	33	28	4	...	...	...	...	65
Columbia	47	5	...	...	...	...	...	52
Crown	1	5	3	3	...	...	...	12
Empire	12	11	3	3	2	...	1	32
All others	2	7	3	2	3	2	...	19
Motors	4	...	...	...	...	...	...	...
Totals	1,539	1,662	241	39	41	3	13	3,538

TABLE VIII.

SHOWING CONSUMPTION IN GALLONS OF ESTIMATED AND METERED QUANTITIES.

Domestic, non-metered	1,076,753,475
Manufacturing, metered	300,000,000
Domestic, metered	190,000,000
Loss in registration, 5 per cent. estimated .	2,450,000
Loss in distribution, 10 per cent. estimated pumpage	187,399,275

CITY PURPOSES.

Street sprinkling	47,390,000
Watering troughs	33,000,000
Schools	17,000,000
Fires	5,000,000
Sewers	3,000,000
Highway Department	3,000,000
Engine houses	2,000,000
Fountains	2,000,000
City Hall	1,000,000
Police Station	1,000,000
Health Department	1,000,000
Cemeteries	500,000
Public Library	500,000
Water Department	500,000
All others	500,000
	<hr/>
	117,390,000
Total	1,873,992,750

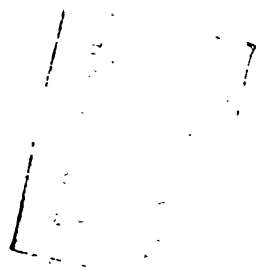
TABLE IX.

SHOWING TOTAL LENGTH AND SIZES OF SERVICES LAID IN LYNN AND SAUGUS.

	6 in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	Total.
Lynn	132	1,068	1,153	4,648	2,717	159	9,877
Saugus				666	1,066		1,732
Total	132	1,068	1,153	5,314	3,783	159	11,609

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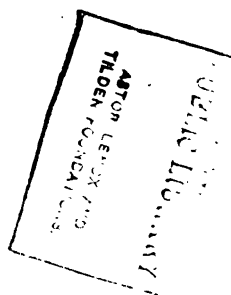


TABLE X.

SHOWING THE SIZE AND TOTAL LENGTH OF IRON PIPE LAID IN 1903.

WHERE LAID.	10 in.	8 in.	6 in.	4 in.	Total.
Beede avenue* . . . . .	...	...	400	...	400
Broad*	2,328	...	...	...	2,328
Carnes* . . . . .	...	...	...	872	872
Chatham* . . . . .	...	...	959	...	959
Ellis* . . . . .	...	...	...	385	385
Fosdick terrace . . . . .	...	...	...	216	216
Ocean* . . . . .	...	1,748	...	...	1,748
Pearl* . . . . .	...	...	790	...	790
School* . . . . .	...	...	454	...	454
Tracey avenue† . . . . .	...	...	48	...	48
Western avenue† . . . . .	...	531	...	...	531
Western avenue*	600	...	...	...	600
	2,928	2,279	2,651	1,473	9,331

	MILES.	FEET.
*Total length relaid	1	3,256
†Total length extended		579
Total length new		216
Total length system	135	125
Total in Swampscott		1,788
Total in Saugus	18	4,752

SUMMARY OF STATISTICS.

FOR THE YEAR ENDING DECEMBER 31, 1903

In form recommended by the New England Water Works Association.

LYNN WATER WORKS, LYNN, ESSEX CO., MASS.

GENERAL STATISTICS.

Population by census of 1900,	68,513
Date of construction,	1871
Owned by	City of Lynn
Source of supply,	Artificial ponds and river
Mode of supply,	Pumping to reservoir

PUMPING STATISTICS.

1. Builders of Pumping Machinery,
E. D. Leavitt, and A. J. L. Loretz
2. Description of fuel used,
 - a. Kind, soft.
 - b. Brand of coal used, Georges Creek.
 - c. Average price of coal per gross ton, delivered, \$5.00.
 - d. Percentage of ash, 9.8.
 - e. Wood, price per cord.
3. Coal consumed for the year, in pounds,
3,654,700

4. [Pounds of wood consumed] $\div 3 =$
equivalent amount of coal, pounds,
- 4a. Amount of other fuel used,
5. Total equivalent coal consumed for
the year $= (3) + (4)$, in pounds, 3,654,700
6. Total pumpage for the year, in gal-
lons, with allowance for slip, 1,873,992,750
7. Average static head against which
pumps work, in feet, 148.58
8. Average dynamic head against which
pumps work, in feet, 150.45
9. Number of gallons pumped per pound
of equivalent coal (5), 512.7
10. Duty $= \frac{\text{gallons pumped (6)} \times 8.34 \text{ (lbs.)} \times 100 \times \text{dynamic head (8)}}{\text{Total fuel consumed (5)}}$ 73,633,725

COST OF PUMPING, FIGURED ON PUMPING STATION EXPENSES,
VIZ., \$15,773.85.

11. Per million gallons pumped, \$8.42
12. Per million gallons raised one foot
(dynamic), \$.005 $\frac{2}{3}$

FINANCIAL STATISTICS.

RECEIPTS.		EXPENDITURES.	
(a) From ordinary (maintenance) receipts,		<i>Water Works Maintenance:</i>	
(b) From extraordinary receipts (bonds, etc.),		AA. Operation (management and repairs),	
Total,		CC. Total maintenance,	
<i>From Water Rates:</i>		DD. Interest on bonds,	
A. Fixture rates,		FF. Sinking Fund,	
B. Meter rates,		<i>Water Works Construction:</i>	
C. Total from consumers,		HH. Extension of services,	
L. From bond issue,		JJ. Increased storage,	
M. From other sources,		KK. Total construction	
N. Total,		Total balance,	
		N. Total,	

DISPOSITION OF BALANCE, TO CONSTRUCTION, 1903.

O. Net cost of works to date,	\$2,810,680.54
P. Bonded debt at date,	2,167,300.00
Q. Value of Sinking Fund at date,	696,434.17
R. Average rate of interest, 4 per cent.	

STATISTICS OF CONSUMPTION OF WATER.

1. Estimated population at date,	81,000
2. Estimated population on lines of pipe,	80,000
3. Estimated population supplied,	80,000
4. Total consumption for the year (gallons),	1,875,197,646
5. Passed through meters (gallons),	490,000,000
6. Percentage of consumption metered,	25 per cent.
7. Average daily consumption in gallons,	5,137,527
8. Gallons per day to each inhabitant,	63.43
9. Gallons per day to each consumer,	64.22
10. Gallons per day to each tap,	365
11. Cost of supplying water, per million gallons, figured on total maintenance (item CC),	\$48.00
12. Total cost of supplying water, per million gal- lons, figured on total maintenance + inter- est on bonds,	\$100.00

STATISTICS RELATING TO DISTRIBUTION
SYSTEM.

MAINS.

1. Kind of pipe,	Cement-lined, and cast-iron.
2. Sizes,	From 36 to 4 inch.
3. Extended during year (feet),	795

4. Discontinued during year (feet),	None.
5. Total now in use (miles),	135
6. Cost of repairs per mile,	\$136.00
7. Number of leaks per mile,	1.61
8. Length of pipes less than 4 inches diameter (miles),	
9. Number of hydrants added during year (pub- lic and private),	2
10. Number of hydrants (public and private), now in use,	965
11. Number of stop gates added during year,	10
12. Number of stop gates now in use,	1,002
13. Number of stop gates smaller than 4-inch,	
14. Number of blow-offs,	66
15. Range of pressure on mains (pounds),	40 to 60

SERVICES.

16. Kind of pipe,	Cement-lined and lead-lined
17. Sizes (inches),	$\frac{1}{2}$ to 4
18. Extended (feet),	11,609
19. Discontinued (feet),	418
20. Total now in use (miles),	100
21. Number of service taps added during year,	231
22. Number now in use,	12,998
23. Average length of service (feet),	40
24. Average cost of service for the year,	\$18.00
25. Number of meters added,	265

PUBLIC WATER BOARD REPORT.

45

26. Number now in use, 3,538
27. Percentage of services metered, 25 per cent.
28. Percentage of receipts from metered water
(B ÷ C), 23 per cent.
29. Number of motors and elevators added,
30. Number now in use, 7









B'D. JAN 16 1913

